

INTERNATIONAL INSTITUTE OF AGRICULTURE
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

INTERNATIONAL REVIEW OF THE SCIENCE
AND PRACTICE OF AGRICULTURE

MONTHLY BULLETIN
OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION

- **The Present Position of Agriculture in the Philippine Islands.** — HERNANDEZ, A., in *Government of the Philippine Islands, Department of Agriculture and Natural Resources, Twentieth Annual Report of the Bureau of Agriculture*, pp 1-65, pl. 7, III, Manila, 1921.

There has never been greater prosperity among farmers nor has there been a year in which greater progress has been made in agriculture in the Philippines than in the year under review (1920). Many causes have contributed to this result but the most conspicuous are the following: 1) The Food Campaign combined with the Rice and Maize Fund which has greatly stimulated increased production; 2) the introduction of modern tractors and gang ploughs in the sugar-growing areas; 3) seed selection; 4) the importation of pure bred sires and consequent improvement of livestock; 5) the establishment and remarkable growth of Rural Credit among small farmers; 6) the establishment of poultry and wine stations and provincial and municipal plant nurseries; 7) the increase in the number of farm advisers and agricultural inspectors; 8) the organization of a plant quarantine service to prevent the introduction of plant pests through importation.

During the period 1910-20, there was an increase of 45 % in the area planted with the 6 principal crops, viz. rice, maize, Manila hemp, sugar, coconuts and tobacco. For the 5 years 1915-19, the average yields of these crops per hectare were as a whole 21 % greater than those for the preceding 5 year period, and the yield per hectare in 1920 was 4 % above the average of the period 1915-1919, notwithstanding the damage sustained through typhoons and floods. This shows the advance made both

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IN
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in area and in yield, but an even greater gain has been made in value. The value of these 6 crops has steadily increased from 159 055 329 pesos (1 peso = 50 cents U. S.) in 1915 to 687 131 502 pesos in 1920. Much of this increase in the value of the products is undoubtedly due to prevailing high prices during and after the war, but a large part is due also to the increase in acreage and yield.

The results obtained during 1920 were significant, not only as showing that better methods have produced better yields, but also as evidence of the able manner in which the farmers continued their cultural operations in the face of adverse weather conditions and floods, coincident with the time for planting and transplanting rice, and also the shortage of hired labour.

RICE (1). — The yield was 8 % greater than in that of the previous year and 33 % more than the average for the 5-year period 1915-19. The production of cleaned rice amounted to 1 019 400 metric tons and was nearly sufficient to supply the demand for local consumption, only 11 000 metric tons being imported.

SUGAR CANE. — The area planted was 1 % less than the previous year (197 403 hectares in all) but the yield was 3 % greater and the highest hitherto recorded, the total production being 423 580 metric tons; the increase in value was phenomenal and amounted to 114 %.

An experiment is in progress to determine which varieties will give good results under the local soil and climatic conditions existing in the La Carlota district, with particular reference to growth of plants and tonnage of cane per hectare.

Analytical tests are also in progress to ascertain the commercial value of old and also of newly introduced varieties.

Acclimatisation and quarantine work is being carried on, and with reference to the first, the varieties Cebu purple and Hawaii-109 promise well. Seed cane propagation, distribution and demonstration work has done much to show the Philippine planters the value of improved method of cultivation. Experiments are being conducted also to determine the effect of wider or of closer planting on the yield of a given variety. Fertiliser experiments are being conducted with the Negros Purple variety to determine the value of lime and native fertilisers; burned lime, cane bagasse ashes, farmyard manure, filter press mud or cake, copra meal and bat guano have been applied in varying quantities. The value of the "Aquila" fertiliser and other varieties is also being tested.

From the breeding experiments so far conducted, the young plant from the seeds of Hawaii-20, Hawaii-27 and "Mountain" (large, white unidentified) are showing the best results.

MAIZE. — The 537 135 hectares planted in 1920 gave a yield of 552 907 350 litres of grain; the highest yield obtained during the past 10 years.

(1) See No. 409 of this Review. (Ed.)

TOBACCO. — This crop also reached its maximum production for the past 10 years, the yield amounting to 64 893 metric tons of leaf from 101 123 hectares, as compared with 56 498 metric tons from 73 859 ha. in 1919, i. e. an increase of 15 % in production, 37 % in area and 52 % in value.

General cultural and seed selection work, acclimatisation of foreign varieties and other experiments have been carried on at Damnas and the newly established Cotabato Tobacco Station.

COCONUTS. — This crop has also created a record during the year, both with regard to the number of trees and the production of copra, which amounted to 361 605 metric tons and consisted of 382 tons of steamed copra, 197 693 tons of smoked copra and 163 530 tons of sun-dried product.

MANILA HEMP. — The area occupied was 559 356 hectares: 4373 ha. more than in the preceding year. The production increased from 148 341 metric tons to 165 081 tons.

For all these crops it is anticipated that there will be a further increase in production with the exception of the Manila hemp, the fall in prices having discouraged growers.

Among other crops, reference is made to: maguey (*Agave Cantala*) :— with the increasing demand for substitute fibres, 30 567 hectares were cultivated as compared with 28 465 ha. in 1919, and the production was 18 178 metric tons as against 12 318 tons.

VEGETABLES AND ROOT CROPS. — The total area devoted to these crops was 141 211 hectares.

LIVESTOCK. — Steady progress has been made, showing that carabaos (buffalos) have increased 96 % (actual numbers 1 388 244); cattle 178 % (678 525); horses 79 % (255 380); hogs 90 % (3 129 776); goats 73 % (731 849); sheep 89 % (168 181).

The principal research work has been in connection with rinderpest. A vaccine has been prepared which will render highly susceptible animals, immune when given in 10 cc. doses. Calves and animals not full grown are given from 8-15 cc. Nearly all the inoculations so far made have proved successful. Experiments also with a semi-dry vaccine have given gratifying results. Hog cholera vaccine is being developed along similar lines. Immunisation experiments have been made with carabaos against tetanus, to ascertain their availability as producers of anti-tetanic serum.

An account is given of the general work and administration of the Bureau of Agriculture and the activities of its various departments. Attention is drawn to the excellent work done by the Demonstration and Extension Division which has done much to initiate the farmers into the modern practical cultural methods elsewhere proved successful.

The Fibre Division has conducted a campaign throughout the year to improve the methods of stripping and preparing fibre for the market. "Prieto" fibre stripping machines were operated to demonstrate the practicability of their use for stripping maguey and sisal. Other similar machines have given good results.

M. L. Y.

361 - Agriculture in Corfu. — MALAMATIONOS, C. J., in *L'Economiste d'Athènes*, Year 1, No. 18, pp. 273-275. Athens, Jan. 19 to Feb. 1, 1922.

The chief crop in the island of Corfu which has an area of 240 square miles and a population of 90 000 inhabitants, is the olive which is grown on the hills. The oil is superior to the Cretan though slightly inferior to that of Mytilene. It is estimated that there are 2 559 000 olive trees in Corfu on an area of 170 000 *stremmes* (42 500 acres) yielding in a favourable year 19 312 500 kg. of oil. As a matter of fact this amount is rarely reached, for the methods both of cultivation and harvesting are poor, and moreover each year about $\frac{1}{3}$ of the crop is destroyed by disease, involving a loss of about 15 million *drachmas*. The Ministry of Agriculture has taken steps to control the olive fly which is the most serious pest. The Berlese system has this year been applied in Corfu and an excellent crop is anticipated.

There are very few oil mills of any importance in Corfu, and less than $\frac{1}{3}$ of the crop is treated in modern factories, the remainder all going to small native mills. The result is a loss both in quality and quantity and the same is the case for the oil of the pomace.

Most of the Corfu oil is sent to the Italian Riviera where it is refined and commands a high price. A refinery should be established in Corfu itself.

Apart from the olive, the vine is also a crop of some importance, the wine being valued at 5 million *drachmas*. The quality of the wine is very high, but owing to the spread of mildew, due to the damp climate, the vine is disappearing and being replaced by hay of poor quality.

There are a fair number of fruit trees, their product being chiefly exported to Piræus. Unfortunately the citrus plants are threatened by the "maladie de Poros" (root-rot and gummosis). This is bound to spread, as the growers reproduce chiefly by layering.

There is also a certain amount of production of cereals and vegetables, the latter being exported to Piræus. Amongst these the potato takes first place, the exportation in 1921 reaching 5 million kg., of a value of 2 500 000 *drachmas*.

The cereals grown in the island are insufficient for the local consumption and importation is necessary. Those most cultivated are wheat and maize. Production could be doubled by the use of modern ploughs, chemical fertilisers, and tested seeds. Agricultural cooperation has thus a great opportunity for fruitful activity.

P. C.

362 - Fleas and the Methods of their Control. — I. BISHOPP, F. C., Fleas and Their Control, in *Farmers' Bulletin* 897, United States Department of Agriculture, 15 pp., figs. 1. Washington 1921. — II. DELANSE, P., Au sujet d'un piége à puces, in *Bulletin de la Société de Pathologie exotique*, Vol. XV, No. 1, pp. 39-41. Paris, January 11, 1922.

I. — The author describes in a popular manner the importance of fleas as agents transmitting infectious diseases to man (bubonic plague, infantile kala-azar etc.) and the lower animals (e. g. tapeworm to dogs) and as irritating and weakening parasites. He also gives an account of their life-history and of the means of exterminating them.

Of the known species of fleas (about 500), less than a dozen are of special interest as parasites of man and lower animals; the most important are the human flea (*Pulex irritans*), the dog flea (*Cnetacephalus canis*), the cat flea (*Cnetacephalus felis*), the fowl flea (*Echidnophaga gallinaceus*), and the rat flea (*Xenopsylla cheopis*), which spreads bubonic plague.

In order to control fleas, it is necessary to remove the centres of reproduction and destroy the parasites on infested animals. If the first operation is well carried out, the second gives but little trouble.

Fleas breed in large numbers in heaps of plant and animal refuse collected in damp shady, places protected from wind and rain. Stock should not be allowed to come near human dwellings, all excrement of any kind should be removed carefully and the place where it has lain (where the flea larvae develop, sprinkled with salt and then liberally watered. The infestation of houses can be prevented by keeping no animals indoors, taking up carpets and washing the boards, first with soap and then with petroleum. All the fleas harboured by domestic animals in a house can be destroyed by washing the hosts with dilute kerosene emulsive. This is prepared by dissolving 31 gm. of ordinary soap in 1 litre of boiling water; the mixture is removed from the fire and 1 ¼ litre of kerosene is added, stirring all the time; when the compound is well emulsified, 20 litres of water are added.

Fumigating houses with sulphur dioxide or hydrocyanic acid destroys rats, fleas and all other parasitic animals; 50-60 kg. of sulphur must be burnt per 1000 cub. m. of volume. Fumigation with hydrocyanic acid must be done with great care; the technique of the operation is described in the *Farmers' Bulletin* 699, intitled "Hydrocyanic Gas against Household Insects".

After the animal hosts have been treated and the house has been thoroughly cleaned, traps may prove useful. In order to attract adult fleas at night a small lamp can be placed in a dish of water covered with a layer of kerosene. Many of the insects may be caught by leaving a rat or guinea-pig in the room all night. The animal must be thoroughly washed in the morning with the solution referred to above.

To allay the irritation produced by flea-bites a 3% solution of carbolic acid, or tincture of iodine may be used.

This bulletin is the second edition revised of the *Farmers' Bulletin* No. 683, November 8, 1915.

II. — The author has used with success a light trap similar to that suggested by BISHOPP but with oil instead of petroleum. He remarks that the trap only acts well if the doors and windows are properly shut so that no external light can penetrate into the rooms.

F. D.

363 — **Lathyrism** (1). — Visco, S., in *Atti della Reale Accademia dei Lincei, Quinta Serie, Rendiconti, Classe di Scienze fisiche, matematiche e naturali*, Vol. XXX, Parts 3-6, pp. 241-244; Parts 7-8, pp. 276-279; Part 9, pp. 379-384. Rome, Second Half-Year, 1921.

A series of observations made on rats fed on the flour of *Vicia Ervilia*

(1) See R. July 1921, No. 701; R. Nov. 1921, No. 1098. (Ed.)

suggested to the author the possibility that the syndrome known under the name of "lathyrism" might be due to a lack of cereals.

In fact one animal, which after an exclusive diet of vetch meal manifested a complex syndrome, was completely and fairly rapidly freed from the symptoms by being fed a commercial product containing vitamins and an infusion (made with cold water) of the bran of *Andropogon Sorghum*.

Pigeons given the seeds of *Vicia Ervilia* manifested the same syndrome of symptoms as others that had been fed solely on polished rice, that is to say, they had every appearance of suffering from avian polyneuritis (due to an avitaminosis), but were cured by being given antiberibercic vitamins.

The rats fed upon bread made from the seeds of *V. Ervilia* (percentage composition of these seeds: nitrogenous substances 23.6; nitrogen-free substances 62.74; ash 3.45; water 13.15; starch 52.90; Crude fibre 5.50; fats 1.90), lost flesh continuously until they reached the limits beyond which it was impossible for life to be sustained, for their food was not sufficient for their requirements in energy, nor did it supply them with the necessary amount of nitrogen. The results of the experiment seemed to show that the deficit in the amount of nitrogen was due to the absence in the feed of some amino-acid radicle. F. D

364 - **Flora of Maize Flour.** — THOM, C., and LE FEVRE E. (Bureau of Chemistry, United States Department of Agriculture), in *Journal of Agricultural Research*, Vol. XXI, No. 1 pp. 179-188, bibliography of 8 works. Washington, 1921.

The authors in seeking possible causes for the well-recognised instability of maize meal, have found by means of cultures that many moulds and bacteria are generally present. The following species of moulds were found to be characteristic in many series of cultures: *Fusarium* sp., *Aspergillus repens*, *A. flavus*, *A. tamari*, *A. niger*, *Citromyces* (or *Penicillium* section *Citromyces*) sp., *Penicillium oxalicum*, *P. luteum* (several varieties), *Mucor*, sp. *Rhizopus nigricans* and *Syncephalastrum* sp. together with various yeasts and yeast-like fungi. Among bacterial groups, the colon-aerogenes group and lacto-bacilli were most abundant in fresh meal. Aerobic spore-formers and micrococci were always present and persisted in the stored product.

Within the range of composition found in the meals of commerce no bacterial activity was detected. Only one grade of unbolted meal showed signs of mould development below 13 % of moisture. Above 13 % of moisture, *Aspergillus repens* began to be an active agent of spoilage up to between 13 and 15 % of moisture, according to the form of milling practised. Several other species of mould are active in meal containing 16 % moisture, and numerous forms, including some bacteria, develop when 18 to 20 % of moisture is found.

Many samples of maize were extensively infected with *Fusarium*, *Diplodia*, *Aspergillus repens* or *Penicillium*, especially in the germinal area and in the tip of the kernel. These portions of the kernel are removed

ed in varying degrees by different milling systems. The bolted meals examined showed a corresponding reduction in the number of viable organisms as shown by cultures.

F. D.

365 - **Suggestions for the Organisation of Stations for Agricultural Research in France and the French Colonies.** — *Revue de Botanique appliquée et d'Agriculture Coloniale*, Year II, *Bulletin* No. 5, pp. 25-26. Paris, January 30, 1922.

AGRICULTURAL
EXPERIMENTA
TION

In the course of its last annual Congress August 1921, the "Association française pour l'Avancement des Sciences" being convinced that :

1) the development of agriculture in France and its colonies should be one of the chief factors of the economic revival of the country ; 2) that scientific methods should be applied to the improvement of useful plants in France and its Colonies ; 3) that it is a proper function of the State to carry out the long experiments and studies necessary for the attainment of practical results, made the following recommendations :

a) That the already existing Experiment Station should be maintained and developed, and that there should be created in France and the Colonies, new specialised Stations for the study of the chief crops to be developed ;

b) That the public establishments engaged in plant acclimatisation or improvement that are already in existence, or that shall be created in the future (Agricultural Experiment Stations, Colonial Scientific Institutes), should be provided with adequate staffs and material and endowed with the means necessary for the continuation of their researches ;

c) That every Experiment Station dependent upon a State Service should draw up annually, before March 31, a report giving an account of the experiments made and the results obtained during the preceding year.

d) That the results obtained should be widely circulated ; that popular pamphlets dealing with the chief crops of the mother country and the colonies should be edited by specialists, printed in large numbers and distributed in the schools and among agriculturists and colonists ; finally, that large numbers of the seeds, cuttings or grafts of acclimatised or improved plants should be placed at the disposal of the public.

G. A. B.

66 - **Agricultural Experiment Stations in Czecho-Slovakia.** — I. *Agricultural Experiment Stations, Bulletin of the Ministry of Agriculture of the Republic of Czecho-Slovakia*, Year III, No 1, p. 6. Prague, January 1, 1922. — *The Budget of the Ministry of Agriculture* (1922). *Ibidem*. — III. *The Sale of the Stock of Chemical Fertilisers at the Ministry of Agriculture, Ibid.* p. 5.

I. — In Bohemia, Moravia and Silesia, there are 25 Experiment Stations devoted to or very closely connected with Agriculture. They are supported either by the State or by autonomous Societies. There are in addition some private Stations.

Most of the Stations have their headquarters in Prague, and this applies to the following which are subordinate to the Chamber of Agriculture : the Physiological Station, Experiment Station of Chemical Fer-

tilisers, Station of Agricultural Bacteriology, Institute of the Dairy Industry, Experiment Station for Testing Agricultural Machines, Soils Bureau, Station of Agricultural Chemistry, Institute of Agricultural Book-keeping, and the Seed Control Station. There is a large Provincial Agricultural Experiment Station at Brno in Moravia, which had a budget of 1 187 600 crowns in 1922; it is supported by an Administrative Committee (an Autonomous Body), and includes several sections. When its organisation is complete, this Experiment Station will be one of the largest in the world. The above Committee also supports an Institute for Plant Improvement, at Pířerov (Moravia).

Experiment Stations are also attached to most of the Agricultural Colleges, as for instance at Tábör, to which are annexed; the Agricultural Experiment Station, the Machine-Testing Station, the Station for the Cultivation of Forage Plants and the Phytopathological Station — at Roudnice; the Station of Agricultural Chemistry, and the Phytopathological Station — at Plzeň; the Dairy Industry Station — at Chrudim; the Plant Improvement Station — at Kroměříž; the Dairy Industry Station — at Prague, the Distillery Industry Institute and the Scientific Brewery Institutes. These two last Stations are annexed to special private schools, while a Carpentry Institute forms parts of the Technical College of Prague, etc.

In Slovakia, the Government has instituted Stations at Bratislava, Košice and Stávnice.

Arrangements are being made for the organisation of other Experimental Stations for the different branches of Agriculture (pisciculture, aviculture, sylviculture, improvement of cattle breeds). At the present time, the Něm-Brod Potato Cultivators' Union is engaged in organising, with the assistance of the Ministry of Agriculture, a special Station on the Valečov estate.

All the Czech Experiment Stations are united in a Federation having its head-quarters in Prague.

In conclusion, there are the private Experiment Stations: the Sugar Industry Station in Prague — the Dobřovice—Seměice Station for the Improvement of Seeds especially those of the sugar-beet, the Joint Stock Company "Thurn-Taxis" which deals with the agriculturists of the different districts of Bohemia, and exports a considerable quantity of sugar-beet seed — the Stations of Chlumec (Nolč-Dreger), Nalžov, etc.

II and III. — The Ministry of Agriculture has included in its 1922 Budget 18 514 427 crowns for Experiment Stations, and 31 399 941 crowns for Primary and Secondary Schools of Agriculture; the support of the Agricultural Colleges devolves upon the Ministry of Education. In addition the profits from the stocks of chemical fertilisers on sale at the Ministry of Agriculture will be employed for the foundation of an Experimental Institute of Agriculture and Sylviculture, the Agricultural Museum and other objects of importance to agriculture.

G. A. B.

367 - **The Standardisation of Field Experiments.** — WIANCKO, A. T., ARNY, A. C., SALMON, S. C. (Committee on Standardisation of Field Experiments), in *Journal of the American Society of Agronomy*, Vol. XIII, No. 9, pp. 368-374, bibliography. Lancaster, Pa., January 28, 1922.

The Committee appointed by the American Society of Agronomy for standardising the methods of conducting field experiments has for many years been making a careful study of the question. Information concerning the practice of the majority of the Experiment Station workers in the United States has been collected. With the data at hand, the Committee now feels that the Society of Agronomy should begin to define and adopt certain standards for locating, laying out and conducting the ordinary kinds of field experiment.

The great variety of conditions under which field experimental work must be done makes it impossible in certain respects to lay down any but very general rules. Some guiding principles can, however, be fixed in order to make such work more uniform and the results more accurate. The chief points in the authors' paper may be summarised as follows:

RECOMMENDED STANDARDS FOR FIELD PLOT EXPERIMENTS IN SOIL FERTILITY. — In each locality, one type only of soil should be represented in any one experiment; it is therefore necessary before beginning the experiments to ascertain the uniform character of the piece of land chosen; topographically, it should be reasonably level and slope in one direction only; otherwise special precautions must be taken to prevent soil-washing. When artificial drainage is required, the drains should be so arranged as to influence all plots alike. Where irrigation is practised, provision must be made to water all plots at the same time and at the same rate. While the size of the plots must often be governed by the number of plots required for the particular experiment, and the amount of land available, twentieth-acre to tenth-acre plots will usually be found the best where horse and machine labour are to be used. Long, narrow plots laid out crosswise to the greatest soil variation are preferable to square or oblong plots as these are more likely to show important differences in soil fertility. The four corners of any series of plots should be indicated by permanent marks. Check plots receiving a uniform soil treatment to maintain them in a reasonable state of productivity should be regularly distributed throughout the series. At least every fourth plot, preferably every third, should be such a check plot in each series, and one or more untreated plots should also be included. The complete series of treatments should be repeated as many times as there are crops in the rotation employed. In all soil fertility experiments, the plots must be separated by untreated interspaces at least 3 ft. in width, and the entire series of plots should be surrounded by regularly planted side and end border strips to be cut off at harvest time. Only high quality acclimatised seed of standard variety should be used and it must be uniformly treated. The calculation of increases due to treatment should be based on the assumption that the difference between the two checks is uniformly progressive. All cultural operations, except ploughing, should be conducted lengthwise of the plots

to prevent all possibility of moving soil or fertiliser from one plot to another. Ploughing should however usually be crosswise of the plot, and hill-planted crops may be cross-cultivated. Yields ought usually to be determined by harvesting and weighing the produce of the entire plot; the produce must be uniformly dried before weighing. Should this have been omitted, the moisture content ought to be determined and proper corrections made before recording the weights.

RECOMMENDED STANDARDS FOR FIELD EXPERIMENTS WITH FARM CROPS. — All seeds used for planting must be of known vitality and free from mixture, weed-seeds and contamination or infection by disease. The soil for experimental plots ought to be as nearly as possible of the type prevailing in the area where the data from the crops grown on them are to be applied. As a rule, relatively long and narrow plots are to be preferred, but they must be sufficiently wide to allow for the removal of border-rows (2 in the case of cereals and 1 for intertilled crops). Practically, 5 ft. or more is a good width for plots planted with small grains and forage crops; in the case of intertilled crops, sufficient width must be allowed for 4 rows. Adequate repetition of varieties or treatments renders unnecessary the use of check plots. In fact the number of years a test is continued together with the number of plots devoted to any one variety or treatment, and the size of the plots are in definite relation to the probable error for any particular test. When single plots of varieties or treatments are used, the probable error will average lower on tenth acre plots than on plots of smaller size. The increase in probable error is however relatively small when the decided reduction in size of the plots is considered. By repeating varieties or treatments a sufficient number of times on regularly distributed plots of any size adapted to the purpose of the experiment, the probable error for the test may be reduced to any point considered necessary. For ordinary conditions, from 2 to 5 repetitions are recommended; 2 plots of any variety or treatment, continued through 4 years, or 3 plots continued for 3 years, should be regarded as the minimum. New varieties and cultural methods or treatments materially different from those in common usage should not be recommended for general use, unless supported by at least 3 years of repeated and carefully conducted experiments within the area for which the recommendations are made.

To the article are appended additions to the bibliography published in 3 previous issues of the Journal of the American Society of Agronomy.

G. A. B.

368 - Experimentation and Yield of Cotton, Sugar Cane, Bay Trees, and Other Crops in Montserrat, West Indies. — Imperial Department of Agriculture for the West Indies. Report on the Agricultural Department, Montserrat 1919-20, pp. 1-40 + tables. Barbados, 1921.

I. COTTON. — As the result of successful cultivation of the strain H23 from 1916-19, further tests were made which proved the undoubted superiority of this strain as regards cropping qualities. This is evident

also from the comparative data referring also to strains Hg and D1. Special note is made of the particularly good results obtained with type H23-2-13 which gave a yield at the rate of 921 lb. per acre. Special work was undertaken to analyse the characters of the individuals of this strain for the purpose of securing mother plants as starting points for a new race with an efficiency above the average of the type. Data relative to the lint length, seed weight, lint index, lint and seed-cotton per boll, percentage of lint, bolls per lb., seed cotton and average number of loculi per boll are given.

New selections are also being made from the Hg strain and several new crosses have given interesting results.

Comparative trials with St-Vincent, Montserrat and St. Kitts cottons are reported and it is noted that the types were placed in the above mentioned order of merit after ginning and forwarding to the factory for ginning tests.

From the 3 200 acres planted in cotton the total yield amounted to 8 334 lb. of lint, i. e. an average of 171 lb. per acre. The practice generally followed was to leave two cotton plants per hill instead of one, and as the results proved most satisfactory, this method is most likely to be followed in the future.

A certain amount of the cotton seed employed, showed lack of viability, and it is advised that as non-viability is due to fermentation or eating of seed-cotton in bulk after picking, seeds which are to be reserved for sowing should be exposed for a longer time to the sun. Trials have shown that if exposed for one week, seeds have proved as viable as when brought from the field.

The type of cotton now cultivated appears to be remarkably free from attacks of bacterial disease in its various forms, and where the cond crops were harvested early, the damage from cotton stainers (*Dysdercus* spp. and *Oxycaenus* spp.) was negligible; late planted areas however suffered badly from attack.

II. — SUGAR CANE. — Comparative trials were made with 22 varieties of cane. Samples of each variety were crushed and the juice, reserved with formalin, was sent for analysis to the Government Laboratory at Antigua. The field results together with the results of chemical examination are given in tabular form. First on the list as regards sucrose value comes the B.H10 (12) with an average return of cane per acre for 2 years of 31.25 tons, giving the average amount of sucrose per acre as 8 180 lb. The next, namely Scaly Seedling gave a somewhat higher average for canes, viz. 33.6 tons, but a lower sucrose production, viz. 370 lb. These two varieties stand first also in the records made as regards the ratoon canes. In 1920 the first mentioned gave 18.1 tons of cane per acre and the second 11.5 tons.

The success obtained with this new variety B. H. 10 (12) confirms the results obtained in other West Indian islands.

III — BAY TREES (*Pimenta acris*) (1). — Reaping of the leaves

(1) Reproduced in *Agricultural News*, Vol. XX, No. 503, p. 246, London, Aug. 6, 1921. (Ed.)

for distillation has been in progress since 1911 and has continued systematically up to the present time (*West Indian Bulletin*, Vol. XV, pp. 176-197). During the 1919-20 season 52 distillations were made and samples of oil from each distillation (100 cc) were submitted to Antigua for examination. The average yield of oil per 100 lb. of green leaves was 17.3 oz.; the phenol content varied from 48 to 63 %. It is interesting to note the rise in yield from 1368 lb. green leaves in 1911 to 8020 lb. in 1919 and the rise in value per acre from £7 to £60. Frequent distillations were made throughout the year to ascertain the most favourable season for carrying out these operations. Details may be found in the Annual Reports of the Botanic Station.

The best average results as regards oil yield were obtained between January and July, but this has been attributed to the dry weather prevailing at this season.

As regards the quality of the oil as indicated by the specific gravity and the phenol content between which a certain correlation is evident, the best results were obtained between March and October.

In consideration of the fact that only fully developed leaves have been used for distillation, nothing has been attempted when the trees were making new growth. The bay trees on the experiment plot are so treated that collections of leaves can be made from ground level, the trees being sawn off and the leaves stripped later. It has been found satisfactory to cut down the trees once a year.

Further investigations must be made as to the right conditions of the leaves when collected as results have been disappointing in cases when very old leaves have been collected.

IV. MINOR CROPS: 1. Yams (*Dioscorea* spp.). — Experiments were made to ascertain the advantage of staking the haulms, and results showed an average gain of nearly 100 % over unstaked plants. The heaviest cropper on the average of 3 years' results proved to be the variety Antigua Lisbon with an average yield per acre of 23 267 lb.; this variety is also of good cooking quality.

2. Sweet potatoes. — Data are given for the average results of the 16 varieties tested. The variety Red Bourbon gave the highest yield the average yield per acre being 13 258 lb.

3. *Datura Metel*. — Dried leaves and ripe seeds of this local plant have been submitted for examination to the Imperial Institute, London to determine the commercial value of the product as a source of scopolomine. Manufacturers reported that satisfactory results were obtained with the leaves and on treating 250 lb. a yield of 0.518 % of crystallised hyoscyamine and 0.0542 % of hyoscyne was given. The proportion of hyoscyamine and scopolomine in the seeds is evidently variable, approximately in the ratio 8 : 1 and this appears to be the first recorded instance in which the hyoscyamine was the predominating alkaloid to such a pronounced degree. The commercial value of the seed is, however, of a doubtful nature, as other available materials contain larger proportions of these alkaloids.

4. *Momordica cochinchinensis*. — A limited number of plants were raised for the first time, and the seeds obtained were sent to Antigua for analysis of the oil content. The seed was composed of shell 38.1 % and kernels 61.9 %; the former contained 0.80 % fat and the latter 52.06 %. The fat obtained was of the consistency of castor oil.

5. *Wind-break plants*. — The results obtained with the following plants are reported. White cedar (*Tecoja Leucoxydon*), Machineel (*Hippomane Mancinella*), Spanish ash or oak (*Inga laurina*), Galba (*Calophyllum Calaba*), Angelin (*Andiria inermis*), Bread-and-cheese (*Pithecolobium Unguis-cati*) and *Pimenta acris*.

M. L. Y.

369 - The Establishment of the West Indian Agricultural College in Trinidad. — In *Agricultural News*, Vol. XX, No. 512, pp. 385-386. Barbados, Dec. 10, 1921, and *The Louisiana Planter and Sugar Manufacturer*, Vol. LXVIII, No. 6, p. 83. New Orleans, Feb. 11, 1922.

AGRICULTURAL
INSTITUTIONS

The object of the establishment of the West Indian Agricultural College is to promote the study of agriculture in the Tropics and to provide instruction in the cultivation and marketing of tropical products of every kind, including sugar, and its by-products, rum, molasses, cacao, coffee, cotton, cocoanuts, rice, citrus fruits, etc., dye weeds and all vegetables, mineral and marine products of the British West Indies (including British Guiana and British Honduras); to make full provision for research work and for the training of scientific investigators in matters relating to tropical agriculture, with a view to creating a body of expert agriculturists capable of founding, establishing and maintaining other colleges, etc., of a similar nature.

Further information as regards the development of the College, the various ways in which West Indian natives are likely to benefit etc. will be forthcoming.

M. L. Y.

CROPS AND CULTIVATION

370 - Studies on the Reduced Yield of the Chief Farm Crops, especially as caused by Adverse Weather Conditions in the United States. — VALGREN, V. N., in *U. S. Department of Agric. Bull.* No. 1043, *Office of Farm Management Farm Economics*, pp. 1-20, Washington, January 1922.

AGRICULTURAL
METEOROLOGY

THE FREQUENCY AND INTENSITY OF ADVERSE WEATHER CONDITIONS. — It is well known that the great variations observed in the yields of cultivated plants are due to unfavourable weather conditions, plant diseases and animal pests. In order to be able to estimate the loss entailed, the author lays stress at the outset on the necessity for a clear definition of the terms "loss" or "damage", when used in connection with crops. The expression "crop damage" should be applied to a loss caused by the inferiority of a crop yield in a given region to the maximum owing to unfavourable weather conditions, whereas the term "financial loss" ought to be reserved for cases where the loss was not only crop damage, or a diminution in yield, but a financial loss on the season's operations.

[368-370]

Let it be assumed that 3 farmers (X, Y and Z) are engaged during a given year in producing wheat by dry-farming methods in three semi-arid regions of the West, and that the average yield in each of these regions for the last 20 years has been 8 bushels an acre which would be sufficient to cover all proper charges. In exceptional years, 35 bushel yields have been harvested on each of these farms.

If in the district where X works average conditions prevailed throughout the year and he actually reaped an 8 bushel crop, he has had neither profit nor loss, though his prospects were early reduced by natural causes. If the climatic conditions had been entirely favourable, he would have reaped 35 bushels per acre. Where Z was farming, all the conditions remained highly favourable, until within two weeks of harvest time, when a hailstorm destroyed 60 per cent of his crop, which gave an actual yield of 14 bushels per acre. In this case there is no financial loss; the farmer realised a profit in as much as 8 bushels per acre covers all charges.

On the other hand the crop was undoubtedly damaged by the hail, and if he had insured it, he would have been entitled to an indemnity equivalent to 60 % of his insurance per acre.

Finally Y, who because of frosts and drought reaped no harvest whatsoever suffered, a loss equivalent to his entire expenditure of labour and capital chargeable to the year's operations; and this is a case of true "loss".

Even after this attempt at clear definition, one of the terms, "crop damage", still retains a vagueness which it seems impossible entirely to remove. It implies that the best crop yet harvested was perfect having suffered no damage of any kind, whereas it may well be questioned if any such crop has as yet been reaped. It is also obviously impracticable to arrive at any figures representing the "crop damage" for a larger area, or for the country as a whole.

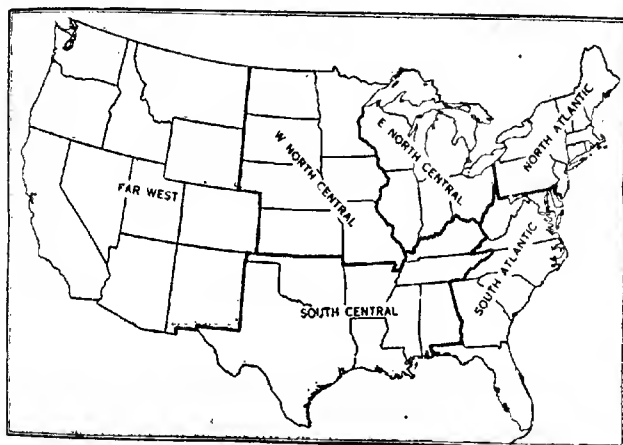
In order to obviate these difficulties and to make it possible to work out approximate figures for the amount of crop damage, from various causes, the United States Department of Agriculture has arbitrarily assumed that a crop exceeding by 10 % the normal yield is a perfect crop. The normal yield is defined as the yield which has been observed by the crop-reporter actually to occur over extended areas in the ratios used in reporting on crop prospects as well as crop damages from different causes.

The difference between a perfect or "no damage" yield and the actual yield, is the measure of "total crop damage". About 12 years ago the United States Department of Agriculture began to require of its thousands of crop reporters in all parts of the country estimates of the percentage of damage caused by adverse weather conditions. The returns were to be expressed in % of the normal crop and calculated according to the standard indicated above.

The crops covered were: maize, wheat, oats, rice, barley, flaxseed, potatoes, tobacco, hay and cotton. Table I gives the data relating to

the 3 leading crops : wheat, maize and cotton. The figures represent the average annual damage during the decade 1909 to 1918 in the 6 great geographical divisions of the United States : North Atlantic, South Atlantic, East North Central, West North Central, South Central and Far West (See figure).

The purpose of Table I is to bring out the relative importance of the different risks or causes of damage with reference to each of the crops enumerated for the country as a whole, as well as for the various geographical divisions. Thus in the case of maize, deficient moisture was the most dangerous risk, not only for the country as a whole, but also for all the geographical divisions ; after drought come excessive moisture, frosts, insect pests and hot winds.



Geographical Divisions of the United States referred to in Tables I and II.

The figures in Table II represent, not only the relative severity of the risks or causes of damage, in each case, but also the importance from the point of view of the acreage or volume of the given crop in the division or the country as a whole.

It is evident that the data given in the two Tables cannot always correspond. Thus according to Table I an average of 1.12 % of the maize crop was lost annually through hail, which was a higher percentage of hail damage than occurred in any of the other 5 divisions, but owing to the relative unimportance of the maize crop in the Far West, the total hail damage was only 300 000 bushels.

On examining Table II it is seen that deficient moisture is again the chief cause of crop damage for each of the crops mentioned ; excessive moisture, however, ranks second for maize, oats, rice, tobacco and hay.

TABLE I. — *Average Annual Crop Damage (in % of Normal Yield) by Geographic Divisions for Decade 1909-1918.*

Crop and Geographical Division	Total loss	Losses caused by climatic conditions									Plant diseases	Insect pests	Animal Other unspecified causes		
		Deficient moisture	Excessive moisture	Floods	Frosts	Hail	Hot winds	Storms	Other climatic causes						
MAIZE															
North Atlantic	24.14	9.58	4.55	0.18	3.57	0.35	0.20	0.61	0.70	0.16			2.23	0.17	1.83
South Atlantic	21.07	9.62	4.31	1.24	0.63	0.33	0.39	0.64	0.24	0.27			2.28	0.15	0.97
East North Central	28.73	11.04	4.79	0.75	4.65	0.26	1.43	0.74	0.43	0.15			2.88	0.10	1.61
West North Central	36.38	19.22	3.64	0.69	3.64	0.69	3.27	0.30	0.51	0.14			2.77	0.23	1.23
South Central	34.62	20.93	3.31	1.28	0.60	0.34	2.80	0.73	0.34	0.37			2.76	0.15	0.96
Far West	29.89	17.51	0.73	0.29	3.43	1.12	0.72	0.12	0.50	0.49			2.94	0.06	1.08
Averages	31.99	16.19	4.00	0.88	2.85	0.44	2.29	0.52	0.44	0.22			2.70	0.17	1.19
WHEAT															
North Atlantic	16.81	3.37	1.36	0.14	1.29	0.24	0.15	0.16	5.18	0.47			3.15	0.03	1.07
South Atlantic	17.61	4.64	2.21	0.39	0.96	0.47	0.24	0.27	3.12	1.23			1.54	0.06	1.43
East North Central	23.06	3.59	2.28	0.38	0.82	0.20	0.44	0.16	9.51	0.77			3.88	0.01	1.61
West North Central	33.04	14.59	2.33	0.35	0.48	1.49	2.99	0.30	3.79	3.92			2.02	0.11	0.97
South Central	32.17	18.09	2.63	0.44	0.33	0.72	1.50	0.19	2.71	1.48			2.77	0.09	1.22
Far West	23.48	12.96	0.77	0.24	1.32	1.22	1.42	0.29	1.81	1.21			0.62	0.81	0.30
Averages	28.77	12.38	2.03	0.33	0.70	1.10	2.02	0.26	4.13	2.65			2.12	0.19	0.86
COTTON															
South Atlantic	27.09	6.60	6.75	1.10	1.99	0.48	0.99	0.60	0.77	3.03			2.85	—	1.31
South Central	38.83	14.53	3.42	1.03	1.05	0.48	1.75	0.75	0.57	1.60			12.35	0.03	1.26
Averages	35.49	12.29	4.34	1.05	1.32	0.48	1.56	0.71	0.50	2.00			9.67	0.02	1.45
OATS Averages															
	24.52	13.44	2.73	0.31	0.38	0.77	1.90	0.43	0.80	1.73			0.89	0.08	1.06
BARLEY	28.65	17.06	1.78	0.14	0.68	1.32	3.17	0.36	0.43	1.65			0.74	0.27	1.29
FLAX-SEED	36.44	21.06	1.25	0.14	3.97	1.72	3.04	0.22	0.39	2.19			0.95	0.09	1.41
RICE	19.04	6.67	3.14	1.47	0.24	0.02	0.43	1.85	0.23	1.18			0.76	0.29	1.28
POTATOS	30.12	14.55	3.08	0.25	1.57	0.14	0.73	0.04	0.45	4.35			3.23	0.08	1.31
TOBACCO	20.50	8.72	3.65	0.64	1.02	0.81	0.19	0.34	0.39	0.40			2.59	0.01	1.24
HAY	20.35	13.44	1.74	0.31	0.62	0.11	0.58	0.15	1.45	0.10			0.52	0.08	1.25

TABLE II — Average Annual Crop Damage from Specified Causes, in Bushels, Pounds, or Tons, by Geographical Divisions for Decade 1900-1918.

Crop and Geographical Division	Total loss	Adverse weather conditions							Plant diseases	Insect pests	Animal pests	Other unspecified causes
		Deficient moisture	Excessive moisture	Floods	Frosts	Hail	Hot winds	Storms					Other climatic causes
MAIZE (bushels)												
North Atlantic	31.9	12.3	6.3	0.2	4.9	0.5	0.3	0.8	0.9	0.2	2.9	2.4
South Atlantic	82.2	39.8	17.5	5.1	2.8	1.4	1.6	2.7	1.1	1.1	0.5	4.0
East North Central	317.4	126.8	53.0	8.3	53.0	2.8	15.5	7.0	4.8	1.7	31.5	1.1
West North Central	388.0	310.8	37.1	10.8	61.4	11.2	55.3	4.7	8.3	2.3	44.5	3.8
South Central	313.7	189.0	31.7	11.5	5.0	2.8	24.9	6.7	3.4	8.5	24.6	1.4
Far West	7.5	4.3	0.2	0.1	0.8	0.3	0.2	—	0.1	0.1	0.7	0.3
Totals	1 345.5	677.0	169.8	36.0	127.9	19.0	94.8	31.9	18.6	8.9	113.8	54.5
WHEAT (bushels)												
North Atlantic	6.9	1.3	0.6	0.1	0.5	0.1	0.1	0.1	2.2	0.2	1.3	0.4
South Atlantic	8.9	2.3	1.1	0.2	0.4	0.3	0.3	0.1	1.5	1.1	0.8	0.7
East North Central	35.1	17.1	3.6	2.0	2.6	8.5	10.5	1.7	18.5	22.5	11.6	1.7
West North Central	178.3	77.4	13.9	2.0	0.2	0.7	1.2	0.2	2.6	1.4	2.5	0.6
South Central	27.5	14.5	2.7	0.4	2.3	2.2	2.7	2.5	3.3	2.2	1.2	1.4
Far West	4.5	24.5	1.3	0.4	2.3	2.2	2.7	2.5	3.3	2.2	1.2	1.4
Totals	301.2	156.1	33.2	3.7	7.3	11.9	31.4	2.9	41.1	28.6	25.9	8.9
COTTON (pounds)												
North Atlantic	870.4	213.3	35.4	64.8	15.4	31.8	31.8	30.7	24.3	95.9	93.8	61.1
South Atlantic	2 860.6	1 078.7	249.8	74.5	75.7	35.0	159.2	33.1	42.1	114.2	912.6	2.4
Totals	3 731.0	1 292.0	464.6	109.9	140.5	56.4	151.0	73.8	66.4	210.1	1 064.4	2.4
OATS (bushels)												
North Atlantic	414.3	277.8	46.0	5.0	6.5	13.4	32.3	7.3	12.5	29.2	15.3	17.5
South Atlantic	74.1	44.7	4.5	0.4	1.9	3.2	7.8	0.9	1.2	4.0	1.9	0.8
East North Central	10.2	6.0	0.3	0.6	1.1	0.5	0.8	0.1	0.1	0.6	0.3	0.4
West North Central	7.4	2.7	1.3	0.6	0.1	—	0.1	0.7	0.1	0.4	0.3	0.1
South Central	166.8	78.6	17.2	3.3	8.9	0.8	3.9	0.2	2.5	25.3	17.4	0.5
Far West	206.3	139.0	55.4	10.0	15.6	12.1	2.7	5.3	5.9	5.3	38.9	25.5
Totals	2 041.0	1 354.0	207.0	30.1	67.0	31.0	58.0	13.6	143.0	100.0	557.0	103.0

In the case of wheat on the other hand plant diseases are the second most important cause of damage with insect pests third; the same holds good for potatoes. In the case of barley, hot winds come second as a source of damage, while cotton insect pests occasion almost as much damage on the average as deficient moisture.

Expressed in terms of dollars, the average annual crop damage during the 11-year period was 2620 million dollars, with a minimum of 2054 million dollars in 1912 and a maximum of nearly 3066 million dollars in 1918.

It must however always be remembered that these figures do not represent the actual monetary loss to farmers, but loss due to adverse weather conditions and already taken into account in judging of the expediency of the agricultural undertakings.

ELIMINATION OR REDUCTION OF RISKS. — Self-Insurance. — One of the best ways of avoiding damage due to bad weather is to avoid monoculture which exposes the farmer to the risk of losing the results of an entire year's work from a single catastrophe. If he invests part of his capital and labour in live stock or in a variety of crops, it is highly improbable that all his sources of revenue or branches of activity will be affected in one and the same year. Many bankers in regions where a one-crop system has prevailed now insist as a condition of granting a loan to the farmer that he shall use a safe-cropping system.

Another way in which the farmer can reduce the risks of crop damage caused by weather is by making a study of the climatic conditions of the region and adjusting the planting, and hence the growing seasons of his crops to the weather. At Grand Rapids, Mich, for instance, the average date of the last killing frost in the spring is May 11, while the average date of the first killing frost in the autumn is about Oct. 8. This gives an average of 150 days without frost. Weather Bureau records further indicate that 5 times in 20 years the date of the last destructive frost in the spring has been 10 or more days later than the average, and that 4 times in 20 years, the date of the first killing frost in the autumn has been 10 or more days earlier than the average. The period absolutely free from severe frosts is thus reduced to a maximum of 130 days. The injurious effects of frosts could be reduced to a considerable extent, if the farmer adjusted his dates of planting to the local climatic conditions and selected the varieties of his seed with due regard to these conditions.

What has been said about frost applies also to drought, excessive moisture and other climatic dangers.

Contracts of Insurance. — Tables I and II give a general idea of the risks and losses to which the producer of crops is exposed independently of his skill or forethought. Even after many of these risks have been reduced or eliminated by the principles of self-insurance already mentioned there remains a large element of risk that can only be adequately met by a reliable contract for indemnity, or in other words by insuring the crop. In 1917, the first attempts at crop insurance were made by three joint-stock fire-insurance companies in Montana, North Dakota and South Dakota. The insurance covered all the risks to which

crops are subject, with the exception of fire, floods, "winter-kill" and neglect. Under this insurance, the farmer insures his wheat at 7 dollars per acre. In the case of partial loss, the Company paid for wheat 1 dollar; flax 1.75 dollars; rye 70 cents; and oats, barley and spelt 50 cents a bushel. These first attempts at general crop insurance proved rather disastrous for the Companies that undertook them, owing in part to the severe drought that occurred in large sections of the States named.

In 1920 new crop insurance policies were issued guaranteeing the farmer against frost, "winterkill", flood and drought, damage due to fire, hail, wind, tornado and failure of seed to germinate being excluded. Unlike the 1917 contracts the policy does not place a fixed value on the grain harvested, but provides instead for a valuation on the basis of market price at the time the contract is signed. The Companies were again severely hit in this case because of an unexpectedly heavy fall in prices.

In a third and still more recent type of policy, the amount of insurance to the acre is based on a certain percentage of the average yield during the past 5-year period, this being translated into dollars by assigning to it a value based in the price prevailing during this period.

Thus a farmer, who had averaged during the past 5 years 48 bushels of maize per acre, may be offered insurance for an amount equal to the value of about 36 bushels at the average price for maize during the past 5 years. This form of insurance is certainly more favourable to the Companies than either of the two preceding forms from which it differs in the following important points:

- 1) In the case of total destruction of the insured crops, the Company agrees to pay 75 % of the cost of the field operations actually performed, such indemnity not to exceed 75 % of the total insurance.

- 2) The indemnity shall in no case exceed the actual value of the lost produce.

PRINCIPLES OF CROP INSURANCE. — The author criticises the different forms of insurance and after considering the question from different points of view, summarises his conclusions as follows:

- 1) The insurance must cover only such crop damage as will result in serious financial loss to the farmer. For establishing the reasonable amount of insurance per acre, the average yield and price for a series of past years is perhaps the best basis. Further the acreage of a given crop, if not the entire farm, must be insured as a single unit and adjustment made on the basis of average yield of such acreage. The total loss of crop on one or two acres out of a hundred is not a serious loss, if the acreage as a whole gives average returns.

- 2) The insurance must cover any and all risks which are beyond the farmer's control. Insurance which protects against certain risks and leaves the insured exposed to total loss from others beyond his control is not an effective crop insurance.

- 3) In no case must the insurance protect against loss from carelessness or negligence on the part of the insured. Such protection is

contrary to sound principle and inimical to the best interests, not only of the company, but also of the insured and of the public in general.

4) The premium or cost of insurance must bear a reasonable relationship to the value of the protection that it purchases; the expense item in the expenditures of the insurance organisation should absorb only a small part of the premiums collected; the profits of the Company must be moderate and the bulk of the premiums must be available for the payment of current claims, or accumulated to form a reserve fund for payments in respect of future losses

5) The method of estimating loss must be such that the insured will receive indemnity for crop damage in such sums as he is led to expect from the figures indicating the amount of insurance per acre.

6) Provision should be made for an early valuation in case of the total failure of an insured crop, or such an approximation to failure that it would not pay to mature and harvest the crop. In all cases, the indemnity should not exceed the value of the labour and other costs, including rental that have been actually lost.

7) All claims involving only partial damage should as far as possible be left until after the crop has been harvested and made ready for market so that the quantity and grade can be determined. G. A.

371 - The Control of the Effects of Wind by Means of Plant Wind-Breaks in Tropical America. — *The Journal of the Board of Agriculture of British Guiana*, Vol. XV, No. 1, pp. 25-26. Demerara, January 1922.

Wind-breaks not only protect plantations from the mechanical action of strong air currents, but also against excessive evaporation and transpiration of the soil and plants, phenomena which are promoted and increased by wind.

The species recommended for wind-breaks in the Antilles and Guiana are those belonging to the genera *Aralia* and *Hibiscus* — *Calophyllum Calaba* ("Galba") — *Mammea americana* — *Eugenia caryophyllata* (clove-plant) — *Swietenia macrophylla* (Honduras Mahogany) — *Mangifera indica* (mango) — *Cinnamomum Camphora* (Camphor) — *Eugenia malaccensis* (jambosa of Malacca).

All these plants make a thick and very high screen, and some of them, such as the camphor tree and clove plant, have also an economic value, while others (*Eugenia malaccensis*, *Mangifera indica*, *Mammea americana*) bear edible fruits. G. A.

372 - Effect of the Length of Day on the Differentiation of Characters of certain Lucerne Varieties and the Possibility of Utilising this Phenomenon as a practical Means of Identification. — OAKLEY, R. A., and WESTOVER, H. L., in *Journal of Agricultural Research*, Vol. XXI, No. 8, pp. 599-607, pl. 111-121. Washington, July 1921.

When the seed of Peruvian, common Kansas-grown, Grimm and Turkestan lucerne is sown in the early autumn in the approximate lat.

ade of Washington, the seedlings at an early stage develop characteristics that make it easy to distinguish the different varieties from one another.

Peruvian lucerne produces erect, sparsely branched seedlings of greater height than the other varieties. They are also more nearly uniform. The Kansas seedlings are very similar to those of the Peruvian variety, but are not nearly so tall and show a greater tendency to send out basal branches.

The Grimm seedlings are still shorter, more branched and less erect. They also showed more variation.

Medicago falcata has yellow flowers, very short stems and a rosette-like habit.

Seedlings from spring sowings at Washington or further north, do not develop differences that are apparent to the untrained eye.

At first it was thought that the temperature of the autumn days was responsible for the striking differences shown by the lucerne seedlings, and it was only after the publication of the results of GARNER and ALLARD's work on photoperiodicity that it was thought advisable to make a test experiment for the purpose of determining whether the difference between the autumn and spring seedlings was due to the length of the day rather than to temperature.

Three series of small plots were sown on January 20, 1921 with the seed of Peruvian, Kansas, Grimm and Turkestan lucernes, and also with *Medicago falcata*. One series was left under normal conditions. In the case of the second the duration of the day was shortened by placing a light-excluding box over the plot from 4 p. m. to 9 a. m. The duration of the light was lengthened for the third series by turning on an incandescent light at dusk and turning it off at 11 p. m.

The seedlings grown under the normal and shortened day behaved essentially like those from sowings made in the autumn. In height the varieties are ranged as follows:

1) Peruvian; 2) Kansas; 3) Grimm; 4) Turkestan; 5) *M. falcata*.

The following are the respective heights of the seedlings as measured on March 3, 1921.

First Series: 1) $3\frac{2}{3}$ in.; 2) $3\frac{1}{2}$ in.; $2\frac{1}{2}$ in.; 3) 2 in.; 5) $1\frac{1}{4}$ in.

Second Series: 1) 3 in.; 2) $2\frac{1}{2}$ in.; 3) 2 in.; 4) $1\frac{2}{3}$ in.; 5) 1 in.

On the other hand there are striking differences in the third series, but the behaviour of the varieties is practically the opposite from that it was in series 1 and 2. In fact at the end of the first month, the seedlings of *M. falcata* and Grimm exceeded in height those of the Peruvian and Kansas varieties. They were also erect and unbranched. Their height in inches was as follows: Peruvian 5; Kansas $4\frac{1}{2}$; Grimm $4\frac{4}{5}$; Turkestan $4\frac{4}{5}$; *M. falcata* 5. From these experiments it is clear that it is the day-night relation of lucernes and not their reaction to temperature that causes the development of marked differences between the seedlings of the varieties of lucerne when the seed is sown at certain times of the year.

By properly controlling the duration of lighting, it is possible by this method, and with little trouble or expense to identify the various lots of seed sent for certification.

G. A.

373 - **Influence of Light and Temperature on Sexual Expression in Hemp.** — SCHAFFNER, J. R., in *The Botanical Gazette*, Vol. LXXI, No. 3, 197-219, fig. 1, 11 pl. Chicago, Illinois, March 1921.

This study was originally undertaken by the author to determine what influence the environment might have on the sex ratio between male and female flowers in hemp (*Cannabis sativa* L.).

CHARACTERS OF FEMALE PLANT. — Well developed root system; robust stem, not so tall as in the male plant; broad, flat crown of leaves; large leaf-blades with more numerous leaflets (5 or more); terminal inflorescence usually leafy; petioles long and robust; female flowers, with no vestigial stamens; weight at the beginning of the flowering period nearly twice as great as that of the male plant at the same age; longer growing period.

CHARACTERS OF MALE PLANT. — Small root system; slender spindling habit and greater height due to the very rapid elongation of the internodes just before anthesis; small leaf-blades with fewer leaflets; shorter and more slender petioles; terminal inflorescences with few or no leaves; male flowers with 3-6 sepals (usually 4 or 5), with no vestige of gynoecium; weight about half that of female plant at time of anthesis; much shorter life than that of female plant.

Hemp planted in spring in the open, under normal conditions produced pure male and pure female plants without confusion of sexuality in the ratio of about 1:1, with deviations in either direction for various plots.

On the other hand, if the sowing was made in winter, in the greenhouse or on shallow benches with low light intensity, there was great confusion in sexual expression. Abundant irregularities were produced such as stamens with normal stigmas, and structures partly male and partly female, as well as more typically bisporangiate flowers and flowers typical of the opposite sexual state (see Table).

Plot No	Female Plants		Male Plants	
	Pure	Mixed	Pure	Mixed
4	60	54	75	57
5	23	30	19	20
8	25	19	12	29
9	19	24	5	29
10	7	16	13	17
11	2	16	2	11
12	4	32	4	13
13	17	26	9	22
14	20	37	5	18
Totals . . .	167	254	144	216

The percentage of intermediate individuals was much higher in the plantings of the winter of 1919-1920 than in those of the winter 1918-1919. This is apparently due to the fact that in 1919-1920, the plants were sown later (in November and December instead of in January and February), and therefore received the minimum of light. The effect of the physical environment is thus already beginning to show itself in the ratio of sexual expression.

The most interesting point is however the sexual reversion which took place to a large extent; both male and female plants showed reversal in their growing period to the opposite sexual state. In extreme cases over 88 % of the female plants became male, and 80 % of the male plants were transformed into females.

The female plants that are partly intermediate from the first, or afterwards become male, produce normal seed, until the transformation takes place. This reversal takes place at a very advanced stage of development (immediately before or after anthesis until extreme old age), therefore the plant retains its female characters with the sole exception of the flowers.

In sex reversal, some individuals produce only imperfect stamens with defective pollen and indehiscent anthers, while others produce quite normal male flowers.

The reversal is usually less complete in the male than in the female flowers probably because with the males, senility sets in soon after the beginning of anthesis, whereas in the case of the females, there is a long active period after anthesis which permits the environmental factors to have full effect in the growing vegetative tissues.

Plots 11 and 12 shewed the greatest degree of reversal of sex; these plots were situated on the north side of the greenhouse where they received the minimum of light and were kept at a lower temperature.

A few special cases were carefully studied in relation to the progressive change in sexual expression. A certain number of normal females produced 2 or 3 normal seeds and then gradually changed to the staminate condition, until finally they bore male flowers only.

The decided sexual dimorphism exhibited by the sporophyte of the hemp is not due to some homozygous or heterozygous condition, but depends upon the metabolic state of the male and female cells, which can be influenced, especially as regards sex expression, by external agents, particularly by light and temperature.

G. A.

374 - On Average Soil Temperature. — EREDIA F., in *La Meteorologia pratica*, Year II, No. 2, pp. 41-48, fig. 1. Montecassino, 1921.

EREDIA states, as a result of his study of the determinations made at the "Osservatorio astrofisico" at Catania in the first place, and also of the observations of other authors, that the annual variation in soil temperature may be expressed by a logarithmic equation. Although in temperate regions the depth to which this variation extends is consider-

able, being certainly never less than 10 metres, in tropical countries, as BOUSSINGAULT had already shewn, the upper layers only are thus affected.

Determinations of soil temperature are of the greatest importance, as they furnish data that are very useful especially in botanical research, if taken to the depth of 1 m. Even if made at different times they are of value when coordinated with other observations of the same character, provided that the temperature of the air is determined at the same time as the soil-thermometer is read (1).

G. A. B.

375 - Soil Temperature and Its Effects on the Development of the Nodules of Leguminosae. — Seen No. 394 of this Review.

376 - Preparation of Soil Solution. — GREAVES, J. E., and HIRST, C. T. (Department of Chemistry, Utah Agricultural Experiment Station, Logan, Utah), in *The Journal of Agricultural and Engineering Chemistry*, Vol. XIV, No. 3, pp. 224-226, bibliography of 23 works. Washington, March 1, 1922.

In the investigation of "alkali soils" it is often difficult to obtain a clear filtrate, because in the watery extract the degree of dispersion of the colloidal disperse phase is so great, and in such a stable form, that the solution may be kept for years without flocculation. The particles of such a phase are so small that it is impossible to separate them by ordinary filtration. It is imperative however that the soil extract should be free from colloidal particles, for coloured colloids interfere with the sharpness of the final reaction in colorimetric and some volumetric reactions, and where the colloid is of a protein nature, subsequent reduction may liberate nitrogen or ammonia, which in the final reaction may be interpreted as nitric nitrogen. Further the colloids may actually combine with one or more of the reagents and produce erroneous results.

The ideal method of obtaining a clear aqueous solution would be one which yielded a clear solution without flocculation. This would necessitate the addition of a flocculent which is rapid in action and will remove only a minimum quantity of the soluble salts from the solution without interfering with the sensitiveness of the method. The results of a comparison of the different agents that can be used for this purpose shewed that clear soil extracts may be obtained by adding to 100 gm. of soil + 500 gm. of water, 2 gm. of lime, ferric sulphate, ferric alum, sodium alum, or potassium alum, and filtering through the Pasteur-Chamberland filter, or centrifuging. The three last processes give a clear solution with a minimum loss of salt. Lime, ferric sulphate and ferric alum cause a considerable loss of nitrates. In the determination of chlorides and nitrates nothing is to be gained by agitating the water and soil for more than 5 minutes, provided the soil is finely divided, and the solution vigorously shaken. A longer time of agitation is required in order to reach equilibrium in a soil solution in which sulphates are to be determined and the actual period will depend upon the quantity and quality of the sulphates present.

(1) See R. Dec. 1921, No. 1199. (Ed.)

When nitrates are to be determined in the soil solution and alum is used as the flocculent, no other antiseptic is necessary; where alum is not used and the solutions are to stand for some time, it is well to add 0.5 cc. of chloroform to each sample; more concordant results are however obtained when the analyses are made immediately and no antiseptic is used.

G. A. B.

Connection between the Hydrogen Ion Concentration of Soils and their Need of Lime. — JOHNSON, H. W. (Iowa Agricultural Experiment Station), in *Soil Science*, Vol. XIII, No. 7, pp. 7-22, figs. 9, bibliography of 25 works. Baltimore, January 1922.

In all the States situated in the wet zone of the United States, the phenomenon of soil acidity occurs; the nature of this acidity is not well understood and very various opinions are held as to its cause. It has been attributed to the presence of mineral or organic acids, to colloidal substances, to adsorption and absorption, and to the effects of specific compounds. More recently, however, the presence of hydrogen ions has been demonstrated and as they are an expression of acid reaction their occurrence denotes real acidity and not a property due to complex theoretical phenomena such as has hitherto been supposed. The presence of hydrogen ions having been proved, their concentration was determined by various authors. These ions may be derived from organic or mineral acids, acid salts, the salts of weak bases and strong acids, compounds which are found in all soils. In any case it is probable that the principal sources of the hydrogen ions of the soil are the acid silicates and the salts of weak bases; iron and aluminium. The different views regarding soil acidity resulted in the adoption of different methods for its determination and the results obtained were so dissimilar that their value is doubtful. In some the apparent acidity was taken into account, in others the real acidity or the adsorption acidity, but in every case the results were expressed under the form of the soil's need of lime. As, however, the comparative value of want of lime and of the hydrogen ions concentration has not been completely determined, the problem is to ascertain the connection, if any, between the need of lime as determined by the various methods and the concentration of the hydrogen ions. If there is any definite connection, the need of lime can be expressed in terms of the hydrogen ions concentration; if no such connection exists, some explanation must be given for the inconsistency of the data relating to want of lime.

In order to decide this question, the author determined the need of lime and the hydrogen ions concentration in 50 very different soils, and found that there is no definite connection between need of lime, as determined by VERRCH's method (neutralisation by lime-water), and the concentration of the hydrogen ions determined by the hydrogen electrode. On the other hand, TRUOG's method (neutralisation by barium hydrate in the presence of carbon dioxide), gives results combining those obtained by VERRCH's method with the data given respecting the concentration of the hydrogen ions.

In soils of similar type there is a connection between apparent acidity and real acidity.

The acidity of soils seems to be due to weathering and leaching, rather than to the accumulation of organic acids; the clay particles and the organic matter act as buffers to lessen the concentration of the hydrogen ions which proves that soil acidity is to be attributed to the disintegration and washing away of the mineral substances, and hence to the resultant formation of acid silicates.

To sum up, it is evident that in the generality of soils, the apparent acidity viz., the need of lime, is in no way connected with the real acidity represented by the concentration of the hydrogen ions; this is the case in soils of different types. On the other hand, where the soils are of similar texture, age, formation and organic matter content, there may be a correlation between the two factors.

G. A. B.

- 378 - **Stratification and Hydrogen-Ion Concentration of the Soil in Relation to Leaching and Plant Succession with Special Reference to Woodlands.** — SALISBURY, E. J., in *The Journal of Ecology*, Vol. IX, No. 2, pp. 220-240 figs. 10. Cambridge, February 24, 1922.

Natural woodlands exhibit a soil stratification in which a definite gradient can be recognised that is reflected in the macro- and micro-organic population. Owing to leaching action, the surface soil is poorest in bases which increase in amount with increasing depth. The organic content on the contrary diminishes with increasing depth associated with which there is a gradient of hydrogen-ion concentration attaining its maximum at the surface. Exceptions are encountered on highly basic soils where the manurial action of the dead foliage may result in a higher base content at the surface than just below the soil. In any case there is a fairly close relation between organic content and real acidity, and "buffer" action (or effect of the latent acidity) is shown to be greatest in the layer of maximum organic content. The view is advanced that woodlands in general and probably all types of undisturbed plant communities in England are tending to become progressively more acid with consequent changes in the character of the vegetation. High forest is most favourable to this succession, while the system of standards-with-coppice with short rotation period tends towards its retardation.

Woodlands occupying valley slopes are inclined to exhibit less marked surface leaching as one descends, and the chief differences between upland and lowland woods are regarded as related to this factor. A depression of vegetative zones related to soil factors is a natural outcome of this process.

G. A. B.

- 379 - **The Carbon Coefficient for Determining the Organic Matter in Soil.** — REED, J. W., and RIDGELL, R. H. (Arkansas Agricultural Experiment Station), in *Soil Science*, Vol. XIII, No. 1, pp. 1-6, bibliography of 9 works. Baltimore, January 1922.

The researches of SCHULZE, WOLFF, FRESSENIUS and van BEMMELN have contributed to extend the use of a conventional coefficient for estimating the organic matter content of soils from the amount of organic

carbon they contain. The value of this method has however been called in question on several occasions, and the author's work furnishes some conclusive evidence on the subject.

He determined the organic carbon present in 37 typical soils (superficial, and sub-superficial, subsoil), from various North American Experiment Stations; the determination of the organic carbon was effected at the same time as that of the organic matter and by means of a special rapid method of dry combustion.

The data obtained proved without exception that the coefficient 1.724 adopted in the belief that the humus contained 58 % of carbon, gives lower results than those obtained by direct determination. In fact, the carbon percentage of the organic matter present in the superficial layer of the soils examined varied from 30.20 to 56.27 %, with an average of 49.26 %, being less by 9 than the percentage obtained by means of the coefficient. In the case of the subsoil, the difference was even greater, the average amount of carbon in the organic matter being hardly 39.16. There is thus every reason to doubt the expediency of adopting an arbitrary coefficient for the carbon content of the organic substances found in the soil. In any case, more accurate results could be obtained by choosing a coefficient based upon a probable carbon content of 50-52 %.

G. A. B.

350—Studies on *Clostridium Pastorianum* as a Fixer of Nitrogen.—I. TUFFAUT, G., and BEZSSONOFF, N., Augmentation du Nombre des *Clostridium Pastorianum* (Winogradski) dans les terres partiellement stérilisées par le sulfure de calcium, in *Comptes rendus de l'Académie des Sciences*, Vol. CLXXII, No. 21, pp. 1319-1321. Paris, May 23, 1921.
— II. Id. Id. Sur les variations d'énergie du *Clostridium Pastorianum* comme fixateur d'azote, *Ibidem*, Vol. CLXXIII, No. 19, pp. 868-870, November 7, 1921.

The effect of partial sterilisation, whether by heat or an agent with a calcium sulphide base, is proved by the fact that, out of 10 tubes of agar mixed with glucose and sown with control soil solution, only 3 fermented, although in the case of the same number of tubes containing partially sterilised soil, 8 underwent butyric fermentation even 8 days after treatment; after 16 days the ratio still remained as 1 to 2. Adopting the dilution method, the number of *Clostridium* per gram was about 100,000, but this figure is far below the real one. Even if it is accepted, it is from 10 to 100 times higher than the figures given by JONES and MURDOCH in the case of *Azotobacter*. The highest counts of these two authors give 1800 organisms per gram, whereas TRUFFAUT and BEZSSONOFF were only able to find 500. It would thus appear that *Clostridium Pastorianum*, and not *Azotobacter*, is the principal agent of the fixation of nitrogen in the soil.

II. — The authors made 2 other experiments by partially sterilising a normal soil and making successive cultures from it. They consider themselves justified in drawing the following conclusions from the results obtained:

1) The partial sterilisation of the soil by means of calcium sulphide not only increases the number of the *Clostridium Pastorianum* in-

dividuals, but also their capacity for fixing nitrogen. This stimulating effect of partial sterilisation is lost after repeated culture in agar mixed with glucose.

2) There is in soil a factor that hinders the growth of *Clostridium* in artificial cultures made with it. The effect of this factor becomes imperceptible when these cultures are sown with dilutions of about 1/100 000.

G. A. B.

381 - Irrigation Schemes in the Niger territory of the French Soudan. — See n° 417 of this Review.

382 - The Improvement of Arable Land and Meadows in Czecho-Slovakia. — *Bulletin of the Ministry of Agriculture of the Republic of Czecho-Slovakia*, Year III, No. 1, pp. 1-2. Prague, January 1, 1922 (1).

Stock-breeding being the most important branch of Agriculture in the Czecho-Slovakian countries, meadow land is of equal importance with arable. According to statistics, there were in 1920: 520 791 hectares of meadow land in Bohemia, 154 982 hectares in Moravia and 30 028 hectares in Silesia; the hay crop was 31.6 quintals per hectare in Bohemia, 29.4 quintals in Moravia and 18.3 quintals in Silesia. The average hay crop is much less than in Germany as the land has not as yet been sufficiently improved. The largest yield per hectare is in the Czecho-Moravian mountains, next come the crops of the Forest of Bohemia (Sumava), and of the Sudetes. The total hay production of Bohemia in 1909 was 16 500 000 quintals, with a value of 136 millions of crowns.

The land improvement works are subsidised by the State and the Local Administrations, the latter having opened Land Improvement Colleges with the object of training the necessary staff. There are 2 such colleges in Bohemia, the course lasting for 2 years. One of the Colleges is at Vysoké Myto and the other at Cheb. In Moravia, there is a third College at Roznov. These Colleges are provided with all the means of instruction, collections and laboratories, a botanic garden, experiment fields and a large experiment farm. The students are chiefly instructed in the science of improving fields and meadows, that is to say, drainage work, constructing irrigation and hydraulic works, aqueducts, road-making and land division etc. After completing their course the students are found posts on the staff of the Provincial Agricultural Councils, in Cooperative Societies for land-improvement, or are employed by Agricultural-engineers in charge of hydraulic works; in some cases they are authorised to carry out less important work on their own responsibility.

The Ministry of Agriculture makes a grant for the improvement of pastures. The neglected grazing-grounds of the Bohemian Forest have been taken in hand with the result that the returns have been increased by 3 million crowns.

The principal means by which the forage crops are increased is by carrying out drainage or irrigation works, or both simultaneously.

(1) See R. Dec. 1921, No. 1194. (Ed.).

Since 1908, an increased development of hydraulic works can be observed. As the duties of the Bureau of Hydraulic Operations, attached to the Council of Agriculture in Prague were continually increasing, branch offices have been opened at Chlumec n. C., Králové, Hradec, Kutná Hora, Hostelec n. O., Velvary and at Soběslav (for the improvement of peat-moors). The impetus that has been given to improvement works in Bohemia is shown by the Statistics for the improvement of arable land and meadows, which give the total superficial area improved between 1885 and 1907 as 35 384 hectares, and the expense of the respective operations as 35 293 000 crowns.

Owing to the improvement of the meadows, the yield per hectare has risen to 50 quintals of hay, and when all the meadows of Bohemia have been improved, the value of the total hay crop will rise from 136 438 crowns (1905), to 71 700 000 crowns. The area of meadow land that has deteriorated from excessive moisture is reckoned at 500 000 hectares, not counting the peat-moors which cover 20 000 hectares.

In Bohemia, as in all the other Provinces, the improvement operations have passed by successive stages from open ditches to pipes buried in the ground. The drainage system is known by different names, according to the materials employed for the work, stones, wood, rods, bricks and pipes.

The improvement work is carried out under the supervision of the Improvement Cooperative Societies which are established in accordance with a law giving them a right to the grants made for the purpose by the State and Provincial Administrative Authorities. These Cooperatives are united in a Confederation at Prague.

Peat-moors are very common in the mountains: the Bohemian Forest, Sudetes, Czecho-Moravian mountains, the neighbourhood of Třeboň, and Blatná and in the basins of the rivers Labe and Jizera.

The improvement of the peat-moors would result in a profit of 6 million crowns. In Bohemia, they are cultivated according to the methods employed in Germany, the Netherlands etc. There are also several factories in Bohemia (Stráž, Nové Hradky and Bastianberg), where excellent peat-moss litter is made.

In the 1922 Budget of the Ministry of Agriculture of the Czecho-Slovakian Republic, the sums allocated to land improvement amount to 23 900 000 crowns; in the Budget of Bohemia, 4 480 000 crowns were set apart for this purpose as against 5 230 000 crowns in Moravia and 64 672 crowns in Silesia.

G. A. B.

382 - Further Experiments with Activated Sludge in England. — RICHARDS, E. H. and SAWYER G. C. (Rothamsted Experimental Station), in *Journal of the Society of Chemical Industry*, Vol. XLI, No. 5, pp. 62-70. London, March 15, 1922.

Preliminary experiments carried out at Rothamsted on the fertilising value of slate-bed and activated-sewage sludge have recently been described (1). The present communication deals more particularly with

(1) See R. 1920, No. 843. (Ed.)

attempts to answer the following questions: 1) Does the activated sludge method recover more of the nitrogen in sewage than the older methods of sewage purification? 2) Is the nitrogen recovered in the sludge in a form available as plant food? 3) What is the source of the high nitrogen content of activated sludge? The enquiry was undertaken at the request of the Ministry of Agriculture, most of the expenses being met by a grant from the funds of the Ministry. In order to test the fertilising value of activated sludge on the field scale and at the same time to obtain information on these points, it was desirable to have a small plant working under direct control and concurrently with the laboratory experiments.

The results of these experiments may be summarised as follows:

- 1) If activated sludge is aerated for a short period in an ammoniacal solution, the recovery of the nitrogen is quantitative. The nitrogen not found as ammonia or nitrate in the effluent is recovered in the sludge.
- 2) If aeration is continued, loss of nitrogen occurs and this loss is roughly inversely proportionate to the volume of sewage present.
- 3) The same effects are observed with sewage. The ammonia falls, while the sludge gains nitrogen with a loss of nitrogen on the whole balance after 16 days' operations.
- 4) There is considerable evidence to shew that the extra nitrogen in activated sludge, over and above that found in the old type sludges, is derived from the ammonia of sewage. There is no evidence of fixation of atmospheric nitrogen.
- 5) The number of protozoa in well-activated sludge approximate to 1 000 000 per gram of wet sludge. The cell content of these organisms alone may account for a large proportion of the extra nitrogen.
- 6) There is complete correlation between the numbers of active protozoa and bacteria in activated sludge under varied conditions of working.
- 7) The increase in bacterial numbers following suppression of the protozoa produces no improvement in purification of sewage. There is, however, a change in the bacterial flora, nitrifying organisms being suppressed by the partial sterilisation. When nitrifying organisms were reintroduced, a greater quantity of nitrate was found in the partially sterilised than in the untreated sewage. The experiments did not, however, enable the investigators to decide whether this is due to larger production or a decreased destruction of nitrate.

Simultaneous experiments carried out at the experimental sewage plant, in which a domestic sewage of rather above average strength and a small proportion of detritus were used, resulted in the production of activated sludge containing 3.5 to 6.8 % of nitrogen calculated on the dried sludge. Very great variations in the methods of working (e.g. in the volume of air, strength of sewage, amount of sludge in tank, and time of retention), produce no appreciable change in the nitrogen content of the sludge. Observations made in working the experiment tank confirm the laboratory experiments designed to find the source of the extra nitrogen content of activated sludge compared with ordinary sewage sludges. They

afford no evidence of fixation of atmospheric nitrogen, but suggest that, in addition to colloidal nitrogen, ammonia is removed from the sewage by physical or biological means or both. Under strongly aerobic conditions, and with a less proportion of sludge in the tank (less than 25 %), the recovery of sludge is practically quantitative (colloids neglected), i. e., its weight is practically the same as the weight of suspended solids in the sewage. If aeration is moderate to poor, and if the volume of sludge is allowed to accumulate up to 50 % or more, over half the dry matter in the suspended solids of the sewage disappears. Variations of conditions influence the nitrogen changes in a similar way, but there is always a loss of nitrogen — under favourable conditions 20 %, under unfavourable 80 % of the nitrogen left in the tank is not recovered.

The proportion of total nitrogen recovered from sewage in normal working by the activated sludge method is greater than by the older methods of sewage purification, viz. 15 % compared with 10 % obtained by recipitation and 4 % by septic tanks. With sewage of half the average strength and supplying twice the normal volume of air per gallon of sewage, the recovery of nitrogen was 27 % of the total nitrogen in the sewage.

The tank experiments also brought out 2 other important points: (1) the great increase in availability of the nitrogen by activation, under continuously aerobic conditions 66 % of the total nitrogen is nitrified in 100 days (under less aerobic conditions only 40 % of the nitrogen in the activated sludge is nitrified), compared with 15 % of sewage solids, and (2) the latter had been lagoon-dried, probably not more than 5 % of the nitrogen would have been available.

The phosphoric acid content of samples of activated sludge is much higher than that found in the old type sewage sludges examined by the Royal Commission (1). These contained from 0.66 to 1.11 % phosphoric acid compared with 2.8 to 3.8 % in activated sludge. The same applies, but in a less degree, to the potash. The amounts of phosphoric acid and of potash have not much manurial importance, but their relation to the total nitrogen content of activated sludge is suggestive of a common biological origin.

Field trials were made with activated sludge at Rothamsted Farm; the first lot was applied to plots for grass and barley, the second for potatoes. No attempt was made to dry the sludges beyond about 90 % moisture content, and they were applied in a pasty condition which made uniform distribution rather difficult. The results obtained showed that generally speaking, activated sludge gave good yields in comparison with sulphate of ammonia and farmyard manure, the nitrogen ratios being equal. It must be remembered that rather less than half the nitrogen in the activated sludge is available in 100 days, while practically the whole of that in the sulphate of ammonia can be nitrified in the time. There is one important difference between the results of these field trials and those ob-

(1) See R. 1915, No. 795. (Ed.)

tained in the preliminary pot-culture experiments, described in the beginning of the article. The dried sludge gave very uniform results in pots, but the wet sludge gave much greater differences between the yields of individual plots than is usual in this class of work. This effect was noticeable with all 3 crops, but no satisfactory explanation can be given to account for the bad agreements between duplicate plots. In any case, however, these field trials show that activated sludge has a high manurial value in marked contrast with the old type sewage sludges tested on the Rothamsted farm in past years. G. A. B.

384 - Experiments with "Rhenania Phosphat" in Germany. — REMY, Th. and WEISKE, F. (Aus dem Institut für Bodenlehre und Pflanzenbau an der Landwirtschaftlichen Hochschule in Bonn-Poppelsdorf.), in *Landwirtschaftliche Jahrbücher*, Vol. LVI, No. 1 pp. 1-37, Berlin, 1921.

The authors have continued their manurial experiments with "Rhenania phosphat" (1) which is obtained by calcining a mixture of phospholite and crude, poor phosphates rich in lime. Six years have elapsed since the first researches were made without any attempt at experiments on a sufficiently large scale. The experiments made in Belgium with a similar product known as "Vesta" phosphate (2) gave excellent results on the whole as compared with those obtained by the use of either superphosphate or basic slag. In the opinion of GRÉGOIRE, "Vesta" phosphate has also an energetic fertilising action, and it would appear that its phosphoric acid and potassium are quite as readily assimilated as that of basic slag and the potassium of the potassic salts used as fertilisers respectively.

The authors undertook 2 series of experiments, one to test the action of "Rhenania phosphat" in the capacity of a phosphatic fertiliser, and the other to determine its action as a potassic fertiliser. They adopted the following methods:

- 1) Except in special cases, they always compared equal quantities of the total phosphoric acid.
- 2) They always compared the potash of "Rhenaniaphosphat" with a parallel series of leucitic potash obtained by the fusion of lime with leucotephrite.
- 3) Since "Rhenania phosphat" and basic slag both contain basic lime, the authors took into account the amount of the lime in the above-mentioned products.
- 4) The potassic fertiliser was always spread before sowing and mixed with the upper 30 cm. of soil.
- 5) The basic fertiliser on the contrary was applied in successive doses.

The experiments were carried out in pots with an artificial soil made by mixing clay with quartz sand, peat, calcium carbonate and ground phospholite. The plants chiefly grown were *Cruciferae* (as being very susceptible to phosphatic fertilisers), hairy vetch, tobacco and potatoes.

(1) See R. 1916, No. 496. (Ed.)

(2) See R. 1919, No. 572. (Ed.)

The following conclusions may be drawn from the results obtained:

a) Approximate equivalence of the phosphoric acid soluble in citric acid present in "Rhenaniaphosphat" and basic slag in 6 out of 10 experiments.

b) The action of the total phosphoric acid of basic slag and of "Rhenaniaphosphat" was equal in 3 out of the 13 cases mentioned.

c) In 4 cases the action of total phosphoric acid of "Rhenaniaphosphat" was greater than that of the phosphoric acid in basic slag.

In 40 % of the cases, the action of the phosphoric acid of "Rhenaniaphosphat" corresponded to its solubility in citric acid; on the other hand, it was greater in 60 % of the cases. This difference in the results depends partly upon the intimate composition of the fertilisers compared and partly on external circumstances.

In the experiments relating to potassium, it was found that it was used in the proportion of 47 to 100 % (average 73 %), of the corresponding value in potassium of potassium chloride. It may safely be said, that the potassium of "Rhenania-phosphat" corresponds to 81 % of an equal amount of potassium in the form of potassium chloride and sulphate. Owing however to the method of manufacture the availability of the potassium decreases as the action of the phosphoric acid increases, but this has only a secondary effect on the total results, because a "Rhenania-phosphat" containing 12 % total phosphoric acid and 3 % potassium would be worth per quintal 60 marks for the phosphoric acid and 1.50 to 2 marks for the potassium, so that the latter becomes a gratuitous supplement to the phosphoric acid.

As regards solubility in citric acid, the phosphoric acid of "Rhenania-phosphat" would seem inferior to that of basic slag. There is, however, no strict proportionality between this solubility and the fertilising power of phosphoric acid, and no results could be obtained from researches in this direction.

G. A. B.

* - Results of Two Years Experiments with Superphosphate "Tetraphosphate" and Phosphorite in Italy. — AVANZI E. (Istituto Agrario della R. Università di Pisa, in *L'Agricoltura Italiana*, Year XLIV, Parts 1-5, pp. 145-155, Bibliography, Pisa, 1921 (1).

These experiments were undertaken with the object of making some contribution to the much discussed question of the efficacy of "tetraphosphate" as compared with mineral superphosphate and phosphorite. They were carried out in two adjoining fields divided into 8 plots. Maize was grown in the fields in 1918, and winter wheat in 1918-1919; the maize succeeded a temporary winter pasture fertilised with farmyard manure; the wheat had been manured with nitrate of soda. The total phosphoric acid content of the superphosphate used was 15.10 %, of which 14.65 % was soluble in water and citrate of ammonium. The tetraphosphate was found by analysis to contain 26.22 % phosphoric acid of which 1.68 % was soluble in 1 % citric acid, while the phosphorite contained respective-

(1) See R. 1920, No. 498. (Ed.)

ly 26.70 and 2.12 % : both the latter compounds were equally finely ground. The phosphatic fertilisers were applied to the maize at the rate of 4 quintals per hectare in the case of all except the control plots.

In the following table the author gives a summary of the results obtained. He calculates the yield indices from the average weight of the crops obtained from the control plots and brought up to 100.

Fertilisers	Maize (1st year)		Wheat (2nd year)	
	Grain	By-products	Grain	By-product (straw and grass)
None (control)	100	100	100	100
Phosphorite	100	101	101	100
Tetraphosphate	109	108	105	105
Mineral superphosphate	120	112	112	106

In order to be able to estimate these results accurately, it must be understood that the productive capacity of the land was high, owing to manuring and working in the preceding years. Hence none of the differences are observed which would occur in the case of soils that had never been fertilised. The differences between the effects of the fertilisers applied are however so noticeable that the following conclusions can be justified.

1) The phosphorite had no appreciable effect upon either the first or the second crop.

2) The tetraphosphate exerted a beneficial effect upon both the first and the second crop.

3) The action of the tetraphosphate upon both crops was less than that of the mineral superphosphate, although the latter had a considerably lower phosphoric acid content. Further, as the difference in the price of the phosphoric acid unit was not proportional to the difference in the efficacy of the two fertilisers, the inferiority of the tetraphosphate is absolute.

Two points still remain to be decided : a) whether under other conditions tetraphosphate would behave differently as compared with superphosphate and phosphorite ; b) the efficacy of tetraphosphate as compared with basic slag. When these points are settled, it will be necessary to consider the economic aspect of the question.

In any case in order to arrive at some definite conclusion respecting the desirability of using phosphorites, and the superiority of one phosphatic fertiliser over another, it would be advisable to carry out further experiments with the object of comparing one or more ground phosphorites with superphosphates, and more particularly with the tetraphosphate obtained from each phosphorite.

G. A. B.

86 - **Studies on Sulphur as a Factor in Soil Fertility.** — I. WOODWARD, J. (Contributions from the Hull Botanical Laboratory 289), in *The Botanical Gazette*, Vol. LXXIII, No. 2, pp. 81-109, bibliography of 73 works. Chicago, Ill., February 1922. — II. BUSHNELL, L. S. (Chief Chemist, Freeport Sulphur Company), A Historical Review of the Research showing the Fertiliser Value of Sulphur, in *The American Fertilizer*, Vol. LVI, No. 4, pp. 80-86. Philadelphia, February 25, 1922.

I. — This investigation was conducted under the terms of a research fellowship from the Gypsum Industries Association, in the United States. Basing his opinion on the analyses made by ROBINSON (1) which show a wide variation in the sulphur content of different soil types, the author considers that other types of soil should be analysed to discover their sulphur as well as their phosphorus content, and, that it is also necessary to conduct field experiments. He therefore analysed 34 average soil and sub-soil samples from Indiana, Kentucky, Michigan, Ohio and Wisconsin for phosphorus, sulphur and the loss on ignition. Fertilising experiments with gypsum were made at the same time in the field of Indiana and Kentucky whence the samples had been taken.

The analytic data show a general relation between the sulphur content and the loss on ignition in soil samples of the same or closely related soil types, but this relation is not apparent when different soil types are compared. The sulphur contents in the surface soil vary from 0.0118 to 0.0905 percent while the phosphorus contents vary from 0.0360 to 0.3407 per cent. All the upland and most of the alluvial soils are poor in sulphur, the high phosphorus content of most of the Kentucky soils, and one of the Indiana soils, is undoubtedly due to the influence of the rock from which they were derived, this being the case with the Kentucky samples, a limestone rich in phosphorus. If the sulphur and phosphorus content of the surface soil (the upper 15 cm.), are calculated and compared with the amounts removed by maximum crops of maize, wheat, timothy, clover and lucerne, it is found that the highest sulphur content is sufficient for only 39 years of lucerne, 139 of clover, 159 of timothy, 355 of wheat, or 232 of maize, whereas the lowest sulphur content is sufficient for only 5 years of lucerne, 18 of clover, 21 of timothy, 46 of wheat or 30 of maize. The lowest phosphorus content is equal to the amount removed by 42 years of maize, 60 of wheat, 80 of timothy, 36 of clover or 20 of lucerne. On the other hand, the maximum phosphorus content would be enough for 401 years of maize, 568 of wheat, 757 of timothy, 341 of clover, or 189 of lucerne.

On some of the soils, tobacco, clover and lucerne were benefited by the use of gypsum. The results are however not quantitative. More field experiments are needed, and greater care should be taken to eliminate other factors interfering with the effect of the gypsum. Each treatment should be repeated in order to reduce the probable error. More satisfactory results would probably be obtained if the work were confined to one field for each soil type, and if each treatment were applied to from 3 to 5 plots in the same field.

(1) See R. 1917, No. 1120. (Ed.)

II. — The author reviews the literature (especially the American literature), dealing with the question of the fertilising value of sulphur and reminds the reader that much less is known about the transformations of sulphur in the soil than about those of nitrogen. The reason is that sulphur is very rarely deficient in soils, and the subject has never been considered of sufficient practical importance to justify extensive investigations.

Instead of thinking of the nitrogen-phosphorus-potash formula as representing a complete fertiliser, it is time to work solely from the standpoint of limiting factors including not only the three above-mentioned, but also sulphur, lime, magnesium and any other factors that influence crop production.

The early failures with gypsum were probably due to the fact that phosphorus or some other element besides sulphur was limiting growth, or that sulphur was not the element required. In any case, the facts recently brought out in regard to sulphur should lead at once to a widespread re-examination of these problems with more carefully designed and more rigidly controlled experiments.

G. A. B

387 - **Differentiation of Character in Young Lucerne in Relation to Length of Daylight.** — See No. 372 of this Review.

388 - **Sexual Expression in Hemp in Relation to Light and Temperature.** — See No. 373 of this Review.

389 - **Chemical Composition of Green Maize at different Stages of Ripening.** — See No. 308 of this Review.

390 - **Occurrence of Quercetin in a Type of Brown-Husked Maize.** — SANDO, C. E. (Junior Chemist, Office of Physiological and Fermentation Investigations, Bureau of Plant Industry, U. S. Depart. of Agric.) and BARTLETT, H. H. (Department of Botany, University of Michigan, Collaborator, Office of Physiological and Fermentation Investigations, Bureau of Plant Industries, U. S. Depart. of Agric.), in *Journal of Agricultural Research*, Vol. XXIII, No. 1 pp. 1-4. Washington, 1921.

In connection with the genetical studies of pigmentation in maize, which have been carried on for several years at Cornell University, the authors made parallel biochemical studies in the isolation and identification of the pigments from material of known genetical constitution. The brown-husked type of maize contains a flavonol viz., free quercetin, and a quercetin glucosid.

The two compounds are both lemon-yellow in colour. If they account for the truly brown colour of the husks of this type, it must be through their tinctorial quality, probably through their adsorption on some colloid component of the brown tissues. It is very probable that the quercetin glucosid is the counterpart in the brown type of the anthocyanin of the purple type of which the pigment will probably be found to be allied to cyanidin.

G. A. B

191 - **Composition of Wild Beets.** — SAILLARD, E., in *Comptes rendus de l'Académie des Sciences*, Vol. CLXXIV, No. 6, pp. 411-412. Paris, February 6, 1922.

The author gives the results of the analysis of two lots of beetroots coming from Primel-Trégastel (Finisterre), and forwarded to him at the request of SCHRIBAUX. The data obtained may prove useful to the breeder who is seeking for roots specially adapted to industrial requirements and capable of transmitting their characters.

Consignment of October 26.

	Average	Maximum	Minimum
Weight of roots	17 gm.	56 gm.	10.80 gm.
Dry matter	32.18 %	35.22 %	29.64 %
Sugar	15.95	19.60	13.80
Ash	1.73	1.98	1.32
Insoluble pulp	9.12	10.48	7.24
Carbonised ash in the residuum	0.46	0.56	0.20
Nitrogen	0.84	0.98	0.63
Water + sugar	83.50	84.38	82.88

These beets, which are smaller and more woody than the beets used in sugar manufacture, also contain more dry matter, as well as more insoluble pulp, more total nitrogen, more mineral substances (about 2 1/2 times as much), and more chlorine, sodium, magnesium, and phosphoric acid.

Their sugar content is equal to or higher than the sugar content of the industrial beets; their sap is less pure and the sum water + sugar lower.

Consignment of December 14.

Sugar	13.00 to 15.56 %
Dry matter	26.40 to 28.40
Carbonised ash	0.98 to 1.28
Total nitrogen	0.33 to 0.49
Insoluble pulp	9.00 to 9.90
Carbonised ash per 100 of residuum	0.34 to 0.40

The figures obtained from this consignment were thus lower than in the case of the first.

These results show that wild beets can be found with as high a sugar content as cultivated beets grown for industrial purposes. P. C.

392 - **Formation of Alkaloids in Belladonna Leaves, in Relation to Solar Radiation.**

— See No. 429 of this Review.

- 393 - **The Influence of Light and of Fluctuating Temperatures on the Germination of *Poa compressa*.** — FRYER, J. R. (Department of Field Husbandry, University of Alberta), in *Scientific Agriculture*, Vol. II, No. 7, pp. 225-230, figs. 5. Gardenvale, P. Q., March 1922.

It has been observed that the satisfactory germination of *Poa compressa* L. is more or less uncertain. In samples, which on external examination, appeared to be full of life, sometimes only 10 to 20 % of the seeds germinated, whereas for other samples of similar appearance the germination percentage rose to 50 or 60 %. Moreover the same samples, when retested, frequently gave results differing widely from those obtained the first time. General observations led to the belief that sunlight and fluctuating temperatures were beneficial to the germination of this seed, but no definite data had been obtained and no literature dealing with the subject was available.

The author made an experiment on the influence of sunlight upon the germination of Canada Blue Grass (*Poa Compressa* L.), and took 12 seed samples for the purpose. Simultaneously with the above tests another experiment was conducted for the purpose of studying the effect of steady temperatures and of fluctuating temperatures. The results showed that sunlight has a somewhat beneficial effect upon the germination of *Poa compressa*. Daily fluctuations of temperature ranging between 15° C and 35° C are probably the best temperature conditions for germination,

G. A. B.

- 394 - **Effect of Soil Temperature upon the Development of Nodules on the Roots of certain Leguminosae.** — JONES, F. R. (Pathologist, Office of Cotton, Truck and Forage Disease Investigations, Bureau of Plant Industry, U. S. Dept. of Agric.) and TISDALE, W. B. (Instructor in Plant Pathology, University of Wisconsin), in *Journal of Agricultural Research* Vol. XXII No. 1, pp. 17-31, figs. 4, pl. 3. Washington, 1921.

The study of a diseased crop of lucerne suggested the idea that soil temperature might affect the development of nodules on the roots of lucerne and perhaps all other leguminosae to such a degree that the assimilation of nitrogen by these plants is greatly modified during the summer. The researches described in this article were carried out with the object of investigating the question. Preliminary studies were made upon the effect of soil temperature on the development of 4 leguminosae; lucerne, red clover, field-peas and soy-beans with special reference to its effect on the infection of these plants by *Bacillus radicum* Beij., and the subsequent development of nodules. The greater number of the data were obtained by growing plants in soil kept at a series of temperatures, ranging from 12° to 36° C with variations of 3° between each. The air temperature was uniform for all the plants, ranging from 14° to 20° C.

As was anticipated, the 4 plants differed in their ability to tolerate soil temperatures at the extremes of the series. Thus peas were dwarfed at 30° C; clover developed poorly at 36° C while lucerne and soy-beans grew very well at that temperature. Soy-bean plants grown in soils kept at 12° — 15° — 33° — 36° C had very dark-green leaves, whereas the foliage

if those towards the centre of the series became progressively lighter, the lightest leaves being found at 24° C.

With regard to the number of nodules formed on plants grown in soil kept at these series of temperatures, irregularities were found in each series, but no large and consistent differences were discovered, except that at the extreme upper and lower temperature limits tolerated by the plant the number of nodules was reduced, although peas usually produced a greatly increased number of nodules at 30° C. In short, all the species studied form nodules in soils at any temperature at which the plant can make a growth that is at all vigorous.

While the variation in the number of nodules was not consistent, their size measured by the average dry weight per plant was found to differ greatly and consistently within the series, at least so far as the soy-bean was concerned. The maximum weight attained for a soy-bean plant after a period of two months was found at a soil temperature of 24° C. Examination of nodules on the roots of the other Leguminosae indicated that their maximum production occurred at about the same temperature.

The weight of the nodules produced by soy-beans was not found to be correlated with the weight of tops or roots through the series of temperatures. In fact, the weight of the tops was practically as great at 30° to 36° C as at 24° C, while the weight of the roots declined rapidly at the higher temperatures. The weight of the roots likewise showed no such diminution at the higher or lower temperature as did the weight of nodules. With the soy-bean plant, and to a much less marked degree with the other plants, there was a correlation between weight of nodules and colour of plants, the largest weight of nodules occurring on plants with the palest green colour. Generally speaking, plants with large nodules had a higher percentage of total nitrogen in the tops, though this correlation is not exact.

As regards the factors of soil environment that may exert an influence upon nodule formation, such as moisture, concentration of nitrates and hydrogen-ion concentration of the soil solution, it does not appear that their variations, influenced in any way the differences in nodule development recorded at the different temperatures in these series. G. A. B.

15 - Observations on Heredity made at the Phytotechnical Station at Abed (Denmark). — VESTERGAARD, H. A. B., in *Zeitschrift für Pflanzenzüchtung*, Vol. VIII, Part. 2, pp. 192-195. Berlin, September 1921.

A series of experiments on lupin, wheat and barley have recently been carried out at the Phytotechnical Station of Abed (Denmark). The following are some of the results obtained:

1) LUPIN. — *Lupinus angustifolius* is a blue-flowered variety, but contains individuals having both red and white flowers.

From the cross *white* × *blue* were obtained, in the F_1 , exclusively blue-flowered individuals, and in the F_2 , blue and white offspring in the ratio of 3 : 1. — From the cross *red* × *blue*, blue-flowered hybrids were obtained in the F_1 , and in the F_2 , blue and red-flowered plants in the ratio 3 : 1.

The blue \times red cross gave in F_1 , blue individuals and in the F_2 , blue red and white flowered plants in the ratio of: 9 : 3 : 4.

There would appear to be two genetic factors concerned, B and b, in the case of the blue flowers; B by itself gives rise to white flowers, and to red flowers.

2) BARLEY. — In 1916, there appeared in a line of native barley No. 867, eight abnormal plants characterised not only by their stiff straw but also by having only 6-7 very closely growing grains situated at the tip of the ear. These seeds were sown; 36 abnormal and 4 normal plants being obtained; the abnormal produced in their turn (in 1918) abnormal progeny only, whereas the offspring of the normal plants consisted of normal and abnormal individuals in the ratio of: 3.35 : 1.

The anomaly was probably the result of mutation in a 1914 plant but owing to the dominance of the normal type, it only came to the light in 1916 as a consequence of segregation.

3) WHEAT. — As a result probably of mutation, a speltoid type of wheat was discovered in a line of wheat known under the name of Abel Storalks (large-eared Abel), and derived from Square-head. The new type differed from the original line in having longer, weaker culms, and longer, thinner and less dense ears. The progeny of the mutant was composed of speltoid and of normal types in the proportion 1 : 1. The normal plants produced exclusively normal descendants, whereas the speltoid continued to segregate into normal and speltoid individuals in the proportion 1 : 1, and may give rise to new types. In this way amongst others a dwarf form and an awned speltoid form have been obtained.

G. A.

396 - The Establishment of a New Vine Selection Station in Austria. — *Zeitschrift für Pflanzenzüchtung*, Vol. VIII, Part. 2, p. 208. Berlin, September 1921.

The Austrian Ministry of Agriculture and Sylviculture has established at Klosterneuburg, near Vienna, a Rebzüchtungsstation (Vine Selection Station) which is attached to the "Höhere Staatslehranstalt für Wein und Obstbau" (Advanced School of Vine-Growing and Fruit-Tree Growing). The new institution has been placed under the scientific direction of Dr. LINSBAUER, the administration having been entrusted to Fr. KOBER, Inspector General of Viticulture.

G. A.

397 - Experiments in Selection and Hybridisation made with the object of obtaining Types of Oats for Norrland (North Sweden). — NILSSON-EHLE, H., in *Svensk Utsädesförenings Tidskrift*, Year XXXI, Part 5, pp. 209-215. Malmö, 1921.

In Sweden owing to high latitude and varying altitudes, there are great differences in the climates of the physiographical zones; it is therefore necessary, in the case of every species of agricultural plant, to obtain distinct types specially adapted to each zone. This fact was recognised from the beginning of plant-breeding and selection in the country. Early maturing kinds of oats must be chosen for Norrland in order that the crop may ripen before the first autumn frosts. The species of oats indigenous to this region have succeeded in the course of time in adapting themselves

to their northern environment with its short summers and small sum total of heat. They ripened much earlier in the comparative cultural experiments than the varieties from districts lying further south. These native oats of North Sweden, although differing greatly from one another in many of their characters, share the following defects: low yield; poor quality of grain (the caryopsids are small and the glumes form a high percentage) weak straw.

There are 3 varieties:

- 1) *Nordsvenska hvithafren* (White Oats of North Sweden), very early, grown in South and Central Norrland;
- 2) *Nordfinska svarihafren* (Black Oats of North Finland), very early, grown in Upper Norrland.
- 3) *Meröghafren* (Meroe Oats), native Norwegian oats of Meroe in the Nordlanden.

Two other very early varieties, *Mesdag* and *Tyshmosshafre* have recently been widely grown in Northern Sweden.

The cultural experiments made at Svalöf have demonstrated the yielding capacity of the early types: *Guldregn* produces a crop from 30 to 40 % higher on an average than *Mesdag* and *Nordfinsk*. There is therefore nothing surprising in the attempts made by agriculturists to introduce into the northern provinces good, heavy yielding, and relatively early-maturing varieties, such as *Ligowo* and *Guldregn*. Good results may be obtained from these varieties in hot years and favoured districts, but in ordinary cold seasons, the setting and ripening of the grain is hindered by the low temperatures, so that the yield of these oats in spite of their specific productivity is lower than that of *Mesdag*.

Hence it is necessary to obtain for North Sweden a type of oat combining the characters of early maturing and specific productivity in order that the grain may develop and ripen in good time. The combination of these two characters has been the object of much research and of many experiments along the lines of physiological selection and hybridisation.

SELECTION. — By means of pure line selection, positive results have been obtained with the Meroe oats from which have been derived a new type 0668, which is both early maturing and productive.

Since however the quality of the grain is poor (the seed being small and having a high percentage of glumes), this new product cannot be used directly, but forms excellent material as a base for further crossing experiments.

"*Nordsvenska hvithafren*" is also not at all homogeneous, but since it is made up of many distinct forms, it could be improved by sorting.

From 1900-1906 the author carried out a continuous series of selections, taking as his starting point the large amount of material collected in 1899 by Prof. HJALMAR NILSSON in the province of Dalarna. The final product of this selection was type 0924 (*Svalöf förädlade Dalahafre* = Dala oats selected at Svalöf), which is markedly superior to the population from which it was derived as regards the quality of the grain.

CROSSING. — The crossing experiments were begun in 1903. Their

chief object was to combine in a single type the good grain quality and high yield of the best varieties with the early-ripening of the oats indigenous in the North. The experiments began with the series Ligowo \times 0660 (0660 = pure line of *Nordfinsk Svarthätre*) and Ligowo \times 0668 (Meroe pure line). Ligowo is distinguished by the good quality of its grain. In the F_2 (1905), as might be expected, very complicated segregation took place.

Out of 670 individuals of Ligowo \times 0665 a certain, but not very high number have the early-maturing character of the 0668 parent. The seeds of 43 of the plants, that were earliest both in heading and ripening, were sown in the same number of plots. From the best of these plots, a new individual selection of 57 plants was made and their seed sown in 57 plots. Some of the most typical and uniform individuals were harvested together and the seed used *en masse* for the raising of a new strain which gave most promising results during the comparative experiments of 1908-1911. After this date, 32 new lines were selected, one of them being put on the market in 1920 under the name of *Orion* Oats *b*; this represented the final results of the cross Ligowo \times 06608.

From Ligowo \times 0660 was subsequently obtained by similar methods the *Bjrn* Oat which proved superior to *Orion* in the Southern part of Norrland. Lately however it has been surpassed by *Odal* which tends to replace it.

Finally in 1906, the cross Guldregn \times 0924 (selected Dala) was made. Guldregn is distinguished by its high yield, the good quality of its grain and the vigour of its culms. From this cross was obtained by final selection the line 01163, which combines in satisfactory proportions the characters of both parents and was put on the market in 1921 under the name of *Odal* Oats.

From what has already been said, it may be concluded that the pedigree selection of native oats and the crosses made have given positive results in the right direction.

In fact from the cross Ligowo \times 0668 was obtained *Orion*, a type particularly suited to the interior and north of Norrland and to the highest zones. It combines with early ripening good quality and quantity of grain and straw; and its culms are more vigorous than those of 0668.

Odal would appear to be the type most adapted to the southern portion of Norrland.

There is no doubt that in these two cases early maturity and productivity have been successfully combined in good proportions with other valuable characters, and it is certain that further improvements can be obtained by continuing to work with uniformity of method along the present lines.

G. A.

398 - Researches on the Question of a Fatuoid Mutation of *Avena Sativa*. -

ÅKERMAN, A., in *Sveriges Utsädesförenings Tidskrift*, Year XXXI, Part 6, pp. 266-270. Malmö, 1921.

In the sowings of cultivated oats (*Avena sativa*) individuals are sometimes found that differ in many points from the common type and bear a

certain resemblance to *Avena fatua*. Thus the glumes (including those of the 2nd and 3rd grain), are furnished with a strong curved awn, while at the base, at the height where the ripe grain becomes detached, the calvus is surrounded by a projecting ring of tissue. There is also a tuft of stiff hairs at the base of the seeds.

These aberrant forms, known under the name of *Fatuoiderna* (= Fatuoid), appear not only in the pure lines, but also in the mixed populations.

In addition to these fatuoid forms, other forms evidently of hybrid origin (heterozygotes) are occasionally seen which naturally have a greater resemblance to the normal type.

The progeny of these heterozygotes segregate into *normal*, *heterozygous* and *fatuoid* forms in the ratio 1 : 2 : 1.

The question of the origin of these forms arises. It was at first assumed that they were due to a natural cross between cultivated and wild oats, but this appears not to be the case, for in the first place, *Avena fatua* is not found in the district of Svalöf where NILSSON-EHLE has made a prolonged study of these anomalous forms, and in the second, as has been shown by the results of TSCHERMAK and SURFACE's hybridisation experiments the segregation in the case of true crosses is very complicated, a large number of characters being involved.

In the present case, except for the few points of difference mentioned above, the new and the original form are precisely similar.

If a hybrid origin is excluded, the fatuoid form must be regarded as a new mutant.

G. A.

9 - Rice Selection in the Philippines. — See No. 409 of this Review.

10 - Behaviour of the Hybrids *Medicago sativa* × *M. falcata* from the Standpoint of the Production of Types of Lucerne Suitable for Central Sweden. — WITTE, H., in *Sveriges Utsädesförenings Tidskrift*, Year XXXI, Part 5, (pp. 185-195) Malmö, 1921.

The author first gives a short account of the cultural experiments tried out in different countries with the object of discovering the most suitable types of lucerne. In Sweden, where lucerne is only grown in the Central and Southern provinces, the best results were obtained with Hungarian lucerne and *Medicago variegata* (*M. sativa* × *M. falcata*), and the latter could with advantage be substituted for the Hungarian variety in districts where great vigour and high resistance to cold are specially required.

The author has for some years been making a number of experiments and researches at Svalöf. From the results obtained, he is led to the conclusion that the climatic conditions of Sweden (heavy rainfall and low temperatures), are not favourable to common lucerne from the point of view of seed production. The plant flowers freely but a very small percentage of the blossoms only set seed.

In 1912, the following seed crop was obtained by the author from 1 strong, well-developed plants:

From 1 plant	no seeds			
» 8 plants	less than 1	gm of seeds		
» 2 plants	» »	1-2	» »	
» 1 plant	» »	5.5	» »	
» 1 plant	» »	7.1	» »	
On average 1.55 gm. per plant.				

With the object of obtaining a vigorous, productive type both as regards forage and seed, the author decided to begin his work with material from *M. sativa* \times *M. falcata*. Crosses can be effected easily without emasculation, all that is necessary is to adopt the usual method of applying the pollen by means of a brush to the flowers to be fertilised, after previous isolation.

The F_1 hybrid has characters that are almost intermediate. Its shoots are more branched than those of *M. sativa* and its habit of growth more open, although not so decumbent as that of *M. falcata*. The colour of the flowers, which in the parents is bluish-violet and bright yellow respectively, becomes in the hybrid a dirty yellow, or greenish-yellow with more or less distinct violet-green veining. The pod is intermediate in shape between the sickle of *falcata* and the spiral characteristic of the common lucerne. Stolon development is more vigorous than in *falcata*, but less strong than in *sativa*. A second growth is rare but it is more vigorous than with *M. falcata* when it occurs.

The hybrid is superior in seed production to either of its parents.

In the F_2 , very complicated segregation takes place. As regards stem length, some of the F_2 hybrids have longer stems and some shorter than their parents; the habit of the hybrids is in most cases open as in the F_1 , but some individuals have erect stems as with *sativa* and in other the stems are decumbent as with *falcata*. The colours are the same as in the flowers of the F_1 , other shades such as light-yellow, violet-brown, bluish-violet and white being also found, all associated with the most various and complicated segregation phenomena.

There is not only an intermediate type of habit, but also of pod, as we see as types similar to the parental, together with all possible intermediate forms and gradations.

It has been mentioned that the F_1 produces abundance of seed; in the F_2 , seed formation is not common and in certain individuals, completely absent. Some of the F_2 hybrids are however very prolific, as is shown by Table I.

These data show that 378 out of 523 F_2 individuals or 72.3 %, produced less than 2 gm. of seed per plant; 111 or 21.2 % produced from 2 to 1 gm., 16 or 3 %, from 6 to 10 gm., 12 from 10 to 20 gm. and one plant only bore 39.8 gm.

In the F_2 it is rare for the plants to shoot a second time but in this respect great variability is shown.

TABLE I. — Seed Production in the F_2 of *Medicago sativa* \times *M. falcata*.

Seed yield in grammes	Number of Plants					Totals	
	Line 37-1919	Line 38-1919	Line 39-1919	Line 40-1919	Line 41-1919	Plants	%
low 0.01	—	5	9	—	—	14	2.7
01-1.99	7	202	118	19	18	364	69.6
10-3.99	1	34	39	5	7	86	16.4
10-5.99	—	9	11	3	2	25	4.8
10-7.99	1	2	4	1	1	9	1.7
10-9.99	1	2	3	1	—	7	1.3
10-11.99	—	3	2	3	—	8	1.5
10-13.99	—	1	1	1	—	3	0.6
10-15.99	—	—	2	1	—	3	0.6
10-17.99	—	2	—	—	—	2	0.4
10-19.99	—	—	1	—	—	1	0.2
10-21.99	—	—	1	—	—	1	0.2
Totals	10	260	191	24	28	523	100.0

Table II gives the forage yield.

TABLE II. — Forage Yield of ordinary Lucerne
and of the Hybrids of *Medicago sativa* \times *M. falcata*.

	Kg. of green mass per hectare			
	1st cut	2nd cut	3rd cut	Total
Ordinary lucerne (Hungarian)	31 750	22 350	13 250	67 350
<i>sativa</i> \times <i>falcata</i> (average of 16 Nos)	35 000	7 000	1 500	43 500
" " No. 21-1919	43 000	7 500	2 000	52 500
" " 32-1919	35 000	13 000	500	48 500
" " 19-1919	19 000	2 000	—	21 000

The first cutting of the hybrid was slightly larger than that of ordinary lucerne, but the second and notably the third cuttings were distinctly smaller.

The author believes that it will be possible by means of continuous and systematic selection, in spite of the complications arising during segregation, to isolate cold-resistant types giving heavy crops of seed and forage, especially for the districts of Central Sweden where the inclemency of the climate precludes all hope of a third cutting.

G. A.

01 - On the Origin of a new Line of Red Clover with short Corolla Tube. — LINHARD, F., in *Zeitschrift für Pflanzenzüchtung*, Vol. VIII, No. 2, pp. 95-120. Berlin, September 1921.

In 1907 NIELSEN observed in a clover field in Bohemia several plants with light-coloured flowers and relatively short corolla tubes. Among

the progeny of these plants, were individuals with pale flowers and short corolla tubes, which in 1911 produced two dwarf plants, all the organs being proportionally reduced in size: stems 10 to 15 cm. in height; flowers very small; capitula small and compact; corolla tube 4 to 5 mm. long. It was not possible to obtain seeds and to propagate this dwarf form. The experiments were continued with the family that had produced the dwarf type. In 1911, the author cross-pollinated two late plants with pale flowers and comparatively short tubes (8 mm.). By repeating the operation in the following years, he soon obtained a line with whitish (very pale violet) flowers true to colour, small compact flower-heads and short tubes. This new line was observed to be very accessible to bees, and the author therefore gave it the name of "Bienenklee", the Apitréfle of MARTINET or bee clover.

The following Table gives in a comparative form the biometric data of the new line and of ordinary red clover.

The Biometric Data of Bee Clover and common Red Clover.

	Bee Clover	Common Red Clover	
	1920	No 3846	No 503
Length of tube (in mm.)	6.91	9.99	(10)
Number of plants	36	11	2
" stems per plant	13.3	21.0	31.5
" flower-heads per plant.	233	253	314
" " per stem	17.5	12.1	10.0
" seeds per plant.	8181	1745	935
" seeds per inflorescence	36	7	3
Total weight of plant, in gm.	145	173	306
" of each plant, in gm.	17.6	3.4	2
" of 1000 seeds, in gm.	2.14	1.90	2
" of seeds in % of total weight.	11.8	2.0	0.

This new line is not only distinguished by its relatively short corolla tube, but also by the large amount of seed it bears.

The short tube facilitates the entrance of the bees by which the clover is pollinated. G. A.

402 - Experiments Researches on the Fertilisation of Red Clover (*Trifolium pratense*) in Germany. — SCHLECHT, F., in *Zeitschrift für Pflanzenzüchtung*, Vol. VII Part. 2, pp. 121-157. Berlin, September 1921.

This paper gives the results of experiments made at the Phytotechnical Station of Hohenheim, with a view to studying the problem of auto-sterility in red clover. The author in the course of his research had also occasion to collect important data respecting the moisture of the air, the percentage of seeds that set, the presence of a new disease of the anthers and the occurrence of pods containing two seeds.

EXPERIMENTAL CONTROL OF AUTOSTERILITY. — For the purpose of isolation, gauze cages 30 × 30 cm. at the bottom and 80 cm. in height were used.

The operation was effected by exerting a slight lateral pressure upon the standard of the keel, so as to expose the stigma and the anthers. The pollen is collected on a brush and applied to the stigma; before passing from one plant to another, the brush must be dipped in alcohol to prevent any chance of cross-pollination.

The author only obtained a total of 10 seeds from 8589 flowers thus treated which may well have been the result of the involuntary introduction of foreign pollen: the autosterility of clover has thus once more been proved.

In order to confirm the results of the experiment, control tests were carried out on several flower-heads of the same plant, some being artificially cross-fertilised, while others were freely exposed to the visits of insects.

In both cases the percentage of seeds set was very high (from 32.8 to 68.5) thus showing that the operations had been very well carried out. It is clear therefore that the failure to produce seed mentioned above is to be attributed exclusively to autosterility.

When self-pollination (with the pollen of the same plant) is effected through the agency of *Bombus*, some seeds are usually obtained; this fact does not however discredit the theory of the autosterility of the red clover, for it is very difficult to find insects in the country that have not already been in contact with several clover plants.

THE AGENCY OF INSECTS. — Can bees act as pollinating agents? It is generally conceded that bees are not able to reach the honey of flowers with too long a corolla-tube. The author carried out 808 biometric determinations and obtained length values ranging from 5.2 mm. to 11 mm. The usual length was 8.9 mm. and the general average 8.7 mm. ZANDER reports that the bee can insert its proboscis to a depth of 7.9 mm.; if this is true, according to the author's statements, 72.5 % of the flowers of the clover would be accessible to bees.

In the control experiments, large gauze cages measuring 85 × 2000 cm. at the bottom and 100 cm. high were used.

The results are summarised in the following Table.

Mode of pollination	No. of inflores- cences	No. of flowers	Fruits set	
			No.	%
Bees	125	11 692	6 328	53.2
<i>Bombus</i>	100	9 517	4 516	47.5
Flowering in the open	100	9 911	4 830	48.7
<i>Totals and averages . . .</i>	325	31 120	15 584	50.1

Thus the bee is as good a pollinating agent as *Bombus*.

EFFECT OF MOISTURE UPON POLLINATION. — Contrary to MARTIN'S conclusions, it would appear that a high degree of atmospheric moisture does not by itself interfere with the process of fertilisation.

TWO-SEEDED PODS. — Sometimes the two ovules produce two ripe seeds.

DISEASE OF THE ANTHERS. — The anthers of the red clover are occasionally attacked and destroyed by a fungus belonging to the genus *Botrytis*, but distinct from the species that are at present known. The author suggests for this fungus the name of *Botrytis antherarum-Trifolii*.

G. A.

403 — Genetic Behaviour of a New Seed Colour in *Trifolium pratense*, in Sweden. — WITTE, H., in *Sveriges Utsädesförenings Tidskrift*, Year XXXI, Part. 6, pp. 257-265. Malmö, 1921.

The colour of the seeds in clover varies considerably in different individuals, but is always uniform in the same individual. The colour-variations range through all possible shades from light yellow to purplish-black.

The author found in addition to these already well-known colours, another very rare hue, whitish-grey, or white, which had never before been observed.

This particular coloration of the seed always occurs in correlation with white flowers, lack of anthocyanin in the sepals and vegetative parts of the plant; we have therefore to do with an albino form. This character is recessive. In fact, if an albino individual is crossed with a normal, progeny with coloured seeds and white seeds respectively are obtained; in the second generation, in the monohybrid ratio: 3:1. G. A.

404 — The Histological Characters of the Root of the Sugar Beet from the Point of View of Selection. — PLAHN, H., in *Zeitschrift für Pflanzenzüchtung*, Vol. VIII, Part II, pp. 195-205. Berlin, September 1922.

Recently, the sugar-beet has been selected less with a view to sugar-content, than with the object of obtaining good root-development, in order to increase the amount of residue which forms an excellent stock-feed.

The present methods of selection, which are based on the polarisation and weight of the root, do not furnish sufficient data to serve as a guide in work directed to obtaining types with high yield and uniting in the best possible proportions both quantity and quality.

The larger size of a root is frequently due to its greater water content, and is not therefore transmissible. In determining the weight of the root it is therefore always necessary to consider the proportion between the water and the dry matter present. The latter alone is of importance from the standpoint of heredity.

In experiments in this type of selection, it would appear that the greatest difficulty is due to the negative correlation between the weight and the sugar content of the root. It is, however, not a question of true

relation, but rather of co-ordinate dependence due to the fact that the heaviest roots contain a large amount of water. This interdependence has been regarded as a basis for generalisation. In reality however types have to be found that combine a high sugar percentage with great weight of root, and the propagation of these types by means of pure lines has been done much to show that sometimes the heaviest roots are also the richest in sugar. In selection therefore, as has been said, the dry matter must be taken into account. In the case of two beets of equal absolute weight, the more valuable from the genetic standpoint is the one in which the ratio of water : dry matter is lower.

This ratio provides the means of judging whether the tissues of the roots are compact or not. The author gives the data for 10 roots. As regards the above ratio, it is possible to distinguish, taking 2.75 as the mean, 6 roots with compact structure (I-III-VI-VIII-IX), with values ranging between 2.71 and 2.61, and 4 roots with loose structure (II-IV-V-X) with values between 2.77 and 2.92. Some excessively large roots (like IV-V), weigh a great deal (763-651-560 gm.) but their structure is far from compact (2.92-2.85-2.90); from the genetic standpoint they cannot be regarded as actually heavy.

If a comparison is made between Nos. II and III as regards weight, we find:

No. II weighs 763 gm. and contains 194.56 gm. of dry matter and 568.43 gm. of water in the ratio of 1 : 2.92.

No. III weighs 684 gm. and contains 188.44 gm. of dry matter and 495.51 gm. of water in the ratio of 1 : 2.63.

or: in favour of II: + 79 gm. ... + 6.12 gm. of dry matter + 72.87 gm. of water in the ratio of 1 : 11.91

The 79 gm. difference in weight is largely due to a greater amount of water. In order to have equivalence, instead of 6.12 gm. of dry matter and 72.87 gm. of water, 21.75 gm. and 57.25 gm. respectively should have been found.

In estimating the actual value of two beets (again taking as a basis for comparison root No. II), the following equation was obtained:

$$763 \text{ gm. (weight of root)} : 191.56 \text{ (dry matter)} = 684 : x \\ x = 174.41 \text{ gm. of dry matter.}$$

As a matter of fact, root No. III which weighed 684 gm., contained 188.44 gm. of dry matter, that is to say, 14.03 gm. more.

In the same way, although root No. II with 79 gm. more weight might be considered equal to No. III, it would be necessary, if this were the case, for the weight of 763 gm. instead of being made up of 194.46 gm. of dry matter and 568.43 gm. of water in the proportion of: 1 : 2.92, to be made up of 210.19 gm. of dry matter and 552.81 gm. of water in the proportion of: 1 : 2.63.

Thus beetroot No. II contains 15.63 gm. of dry matter + 15.62 gm. of water and its value is therefore lower than that estimated for beetroot No. III.

If the dry matter content of these roots is calculated in this manner and the average taken as 141.87 the following values are obtained :

No of roots	Actual Value	Proportional Value	Difference
	gm.	gm.	gm.
I	214.65	212.00	+ 2.65
II	194.56	203.47	— 8.91
III	188.44	182.40	+ 6.04
IV	168.93	173.60	— 4.67
V	145.52	151.47	— 5.95
VI	117.54	116.27	+ 1.27
VII	102.98	99.47	+ 3.51
VIII	102.43	98.93	+ 3.50
IX	98.55	94.67	+ 3.88
X	85.13	85.60	— 0.47

Therefore the 6 roots with compact structure come in the following order III — IX — VII — VIII — I — VI.

On the other hand if we apply von RÜMKE's correction for the ratio between weight and sugar content and take as a basis of comparison the average weight of a root weighing 532 gm. with 20.72° of polarisation we obtain for root I :

Weight of root I	= 795 gm	
Average weight of all the roots = 532 gm	. . .	Corresponding polarisation = 20.72°
Difference in favour of No. 1 = + 263 gm	. . .	von RÜMKE's correction = 0.77°
		Corrected polarisation . . = 19.95°
		Polarisation of root No. 1 = 19.10°
		Difference = 0.85

For the more compact beetroots, the following values are obtained.

$$IX = 1.61; III = 1.25; VI = 0.63; VII = 0.14; VIII = 0.09.$$

The results of determining the dry matter on the one hand, and the weight of the root and the polarisation angle on the other, do not agree. Therefore, the present methods of selection, which are based on the polarisation and weight of the root, cannot yet be considered as satisfactory.

The polarisation data must be corrected by the sugar content of 100 parts of dry matter, and the structure and absolute weight of the root should also be taken into account .

G. A.

405 — A Bio-Chemical Index for Determining the Vitality of Seeds (1). — NEMEGYI and DUCHON, F., in *Comptes rendus de l'Académie des Sciences*, Vol. 174, No. 6, pp. 631-634. Paris, February 1922.

The authors have shown (*Comptes rendus* Vol. 173, 1921, p. 933) that the activity of the catalyst affords a rapid and easy means of determining

(1) See R. March 1922, No. 253. (Ed)

ining the vitality of seeds. They adopted the following method: 2 gm. of finely ground seeds are mixed with 20 cc. of distilled water and put into a flask with a rubber stopper provided with two holes through one of which passes a funnel with a regulating tap, while an escape tube with two bends passes through the other and thence into a vessel of water and under a gas-bell graduated to tenths of a cubic centimetre. By means of the funnel are introduced 15 cc. of 3 % oxygenated and neutralised water and the amount of oxygen liberated is measured after 5 minutes, and later after 15 minutes.

The results of many experiments have demonstrated that all other factors being equal, the amount of water decreases regularly with the weakening of the germinative capacity.

These results expressed graphically give a regular curve and thus the germinating power of the seeds can be deduced from the amount of oxygen liberated.

In practice, it is well to use the comparative method, and to compare the catalytic activity of the ground seeds under examination with the graphic curve obtained under the same conditions from seeds of known germinative power.

P. C.

406 - **The Exportation of Red Clover Seed from Czecho-Slovakia.** — *Bulletin of the Ministry of Agriculture of the Czecho-Slovakian Republic*, Vol. III, No. 1, p. 8. Prague, January 1, 1922.

The seeds of forage crops, especially those of Red, White, Swedish and Crimson Clovers (after which comes the seed of Sainfoin etc.), are among the most important agricultural products exported from Czecho-Slovakia. Statistics show that the following quantities of clover seed were produced in 1920: in Bohemia, 121 098 quintals; in Moravia 45 157 quintals; in Silesia 3 341 quintals, in Slovakia, 34 993 quintals; in Sub-Carpathian Russia, 2895 quintals; the total production amounting to 207 484 quintals. Owing to its excellent qualities this seed finds a ready market abroad, especially in England, Scandinavia etc. In 1921, about 300 trucks of red clover seed were exported. There are certain restrictions on its exportation, for as adverse climatic conditions have damaged the clover crops in Czecho-Slovakia, the Government has been compelled to limit the consignments of clover seed sent abroad, in order that the farmers may have sufficient for their own requirements. On the other hand, the Experiment and Seed Testing Stations are protecting the reputation of Czecho-Slovakian clover seed by guaranteeing its purity, power of germination, and freedom from any admixture of weed seeds.

G. A. B.

497 - **Steady Decline in Price of Vegetable Seeds in the United States since 1918.** — *Weather, Crops and Markets*, Vol. I, No. 7, p. 129-146. Washington, D. C., Feb. 18, 1922.

Prices quoted for vegetable seeds, both by retail mail-order and wholesale dealers in the United States, are almost uniformly lower than in 1921, and, for most items, the lowest since 1917. The decline has been constant since 1918, when the peak was reached for most kinds. The accompanying table of retail catalogue and wholesale prices show that the prices of beans,

peas, sweet maize, lettuce, and vine-crop seeds fluctuated less violently than did other seeds, including beets, cabbage, celery, spinach, and turnip, of which large quantities normally are imported.

Average Wholesale (Wh) and Retail Catalogue (R) Prices of Standard Varieties of Vegetable Seeds (\$ per pound)

Kind of seed	1917		1918		1919		1920		1921		1922	
	Wh.	R.	Wh.	R.	Wh.	R.	Wh.	R.	Wh.	R.	Wh.	R.
Beans, dwarf . . .	0.18	0.32	0.26	0.43	0.21	0.41	0.16	0.39	0.15	0.39	0.13	0.37
Beans, garden pole*	0.14	0.26	0.24	0.41	0.23	0.43	0.21	0.40	0.19	0.41	0.15	0.39
Beet, garden . . .	0.90	1.30	1.45	2.35	1.07	1.75	0.64	1.35	0.48	1.15	0.38	1.00
Beet, mangel . . .	0.75	0.55	0.90	1.30	0.68	1.20	0.36	0.90	0.31	0.80	0.27	0.70
Cabbage	1.90	3.00	3.80	5.05	8.00	11.10	2.75	5.25	2.40	3.90	2.00	3.15
Carrot	1.00	1.40	1.75	2.25	0.90	1.70	0.50	1.30	0.50	1.10	0.40	1.00
Celery, domestic	1.50	2.60	2.25	2.85	1.85	2.90	1.60	3.20	2.00	3.00	1.60	2.75
Celery, imported	10.00	17.00	10.00	15.35	5.00	13.55	4.00	10.45	4.00	9.85	3.00	9.05
Cucumber	0.54	0.95	0.83	1.75	0.85	1.30	0.86	1.30	1.80	1.40	0.81	1.35
Lettuce	0.65	1.35	0.85	1.40	0.90	1.50	0.72	1.55	0.76	1.60	0.76	1.55
Muskmelon	0.54	1.10	0.78	1.30	0.81	1.35	0.73	1.50	0.79	1.50	0.76	1.50
Watermelon	0.42	0.80	0.70	0.95	0.54	1.15	0.46	1.10	0.45	1.15	0.46	1.05
Onion seed	1.90	2.50	4.50	5.15	2.65	3.80	1.80	3.15	1.60	3.00	1.20	2.55
Parsley	0.35	0.90	0.60	1.05	1.00	1.25	0.60	1.10	0.60	1.10	0.50	1.10
Parsnip	0.30	0.70	—	1.75	1.00	1.80	0.40	1.25	0.35	1.05	0.35	1.00
Peas, garden . . .	0.12	0.23	0.19	0.37	0.19	0.38	0.24	0.45	0.19	0.42	0.14	0.37
Radish	0.40	0.65	1.60	1.65	1.30	1.65	0.60	1.30	0.50	1.15	0.50	1.10
Spinach	0.60	0.90	2.00	2.10	0.75	1.25	0.35	0.80	0.20	0.70	0.20	0.60
Squash, summer . .	0.65	0.95	0.80	1.40	1.05	1.50	1.00	1.65	0.90	1.65	0.75	1.50
Squash, winter . .	0.55	0.95	1.00	1.50	1.10	1.60	1.10	1.70	1.00	1.60	0.80	1.40
Sweet corn	0.20	0.26	0.25	0.38	0.17	0.35	0.15	0.36	0.13	0.36	0.10	0.32
Tomato	2.75	2.95	3.60	4.10	4.00	4.45	3.25	4.45	3.10	4.25	2.80	3.90
Turnip, English . .	0.35	0.70	1.75	1.95	1.35	2.05	0.65	1.40	0.50	1.15	0.35	0.95
Turnip, Swede . .	0.32	0.65	1.50	2.35	1.25	2.05	0.45	1.35	0.37	1.00	0.27	0.90

* Not including Lima beans.

Any changes in the price of the former group, of which the domestic production is usually sufficient to supply the needs of the United States, may be attributed largely to variations in the cost of production and preparation for market. The supply of the latter group, however, was not controlled by domestic commercial growers and with imports suddenly cut off, the high prices prevailing in 1918 followed. Likewise the rally of domestic growers to supply the deficit thus created, followed by the rapid resumption of imports, caused these items to decline quickly to their 1917 price levels.

On the whole, wholesale prices for 1922 compared with 1921 show a greater reduction than do the retail catalogue prices. The wholesale prices of beans, peas, sweet maize, beet, cabbage, carrot, celery, onion, parsley, squash, and turnip are 15 %-30 % less while the retail-catalogue prices of these items, with the exception of cabbage and English turnip, are only 5 %-15 % less than last year. Very little change, if any, occurred in the

wholesale prices of other kinds of vegetable seeds except tomato which is quoted 10 % less. The average retail prices of tomato declined 8 %, spinach 15 % and watermelon 9 %; cucumber, lettuce, muskmelon, parsley, parsnip, and radish were unchanged to slightly lower.

G. A. B.

108 - **Reliability of the Nail Test for predicting the Chemical Composition of Sweet Maize.** — APPLEMAN, C. O. (Maryland Agricultural Experiment Station), in *Journal of Agricultural Research*, Vol. XXI, No. 11, pp. 817-820. Washington, September 1921.

In carrying out the nail test, the thumb-nail is thrust into the kernel, and the exudate examined which is opalescent, milky, creamy and doughy in the 4 successive stages of ripening; at the last stage, the kernels begin to turn yellow.

The author made parallel and comparative experiments with sweet-maize and found from the results of chemical analyses of the kernels that the nail test was reliable, although its reliability is influenced by the rate of ripening and of water loss by evaporation.

He also discovered that :

The corresponding stages of crops ripening under different climatic conditions vary both in uniformity of composition and average percentage composition.

The percentage composition of the carbohydrates in the milky stage of a late crop was much more uniform than in the same stage of an early crop.

The nail test is most reliable when applied to crops that ripen slowly in a cool autumn.

In each of the ripening stages, except the dough stage, the percentage of total sugar was more constant than the percentage of starch.

As ripening proceeds, the increase in the percentage of starch is much greater than can be accounted for by the decrease in the percentage of sugars. From the beginning of kernel formation until the end of the ripening period there is a continual movement of sugar from the plant into the kernels where it is transformed into starch. The following Table gives the average percentage of the composition of kernels of sweet maize of a late and early crop respectively, as indicated by the nail test. The percentages are calculated with reference to the dry matter content.

Percentage Composition of Sweet Maize at Different Stages of Ripening.

Crop	Pre-Milk Stage		Milk Stage		Early dough Stage		Dough Stage	
	Total sugar	Starch	Total sugar	Starch	Total sugar	Starch	Total sugar	Starch
Early . . .	42.013	22.080	29.183	38.911	13.515	56.519	8.786	59.422
Late . . .	51.200	24.080	35.297	33.475	15.328	50.975	—	—

F. D.

[407-408]

409 - **Rice in the Philippines.** — CAMUS, J. S. (Agronomist in Charge of Agronomy Section) in *Government of the Philippine Islands, Department of Agriculture and Natural Resources, Bureau of Agriculture, Bulletin No. 37*, pp. 1-87, tables 10, pl. XLVII. Manila, 1921.

The author gives detailed information as to the climatic conditions, soil and cultural operations associated with rice growing and the cost of production, preparation of grains for the mills and utilisation of by-products, and describes the latest tests and experiments conducted by the various Philippine Experiment Stations especially with reference to varieties, selection, etc.

This bulletin was prepared primarily as a practical guide to the ordinary rice grower of the Philippines, but as it is based on 11 years of experimentation by the Bureau of Agriculture, it is also of fundamental interest to the scientific agriculturist. Certain points of special interest have here been selected.

1) **TYPES OF GRAINS AND VARIETIES.** — The commercial varieties of grain measure usually 2.5 mm. \times 5.5 mm., but vary considerably in shape and also in colour. The varieties used for general consumption belong to the non-glutinous group.

Experiments made with a view to the selection of improved varieties of lowland rice (transplanted) have been conducted at the Alabang and Pangasinan Stations, and of upland rice (non-transplanted) at La Carlota and Linao. Data with reference to habitat, age at heading, maturity and yield for each variety were taken and careful records kept of the best varieties determined.

Most of the lowland varieties tested have shown a comparatively limited range of yields, which will necessitate further trials for some time. Except for timing the planting and harvesting to profit by the average weather conditions, it is not considered advisable to grow a variety that requires more than 150 days to mature. The Apostol (originally known as Señora II) was found to be one of the best varieties and its characteristics may be summarised thus: number of days required from sowing to heading 112, from heading to maturity, 32; yield per hectare 23.83 kg.; shape of grain, somewhat thick, linear oblong, breadth 2.98 mm.; hull straw coloured, medium thickness, non-bearded; cuticle white; average length of head at harvest 29.5 cm., average number of grains per head 151; flavour medium.

The 44 most promising varieties out of 282 have already been improved by means of the head-to-row test. Pure strains of these varieties have been isolated, propagated and the seed produced was distributed throughout the Philippines. The varieties tested thus were: Apostol, Cruz, Inasimang, Macan I, Piniling, Daniel, Comer and Roxas. The average yield was 26.48 kg. per hectare; the first four matured earlier than the last three; all of them are non-glutinous and non-bearded.

As regards the Upland varieties out of the 431 tested, the following 11 are recommended for general planting. — Bagonhon II, Binicol I, Catalong, Dinagat I, Inantipolo II, Kinandang Puti II, Kinastila IV, Nagsdami, Nagsaya, Pulupot and Saloot. Of these the Kinandang Puti II

matured earliest (106 days). The average yield for these 11 varieties is 22.56 kg. per hectare; all are non-bearded.

As a result of all the breeding experiments undertaken, it has been shown that by using selected seed the production of rice has been almost doubled.

SOILS AND MANURES — In the best rice producing provinces such as Nueva Ecija, Pangasinan, Tarlac, Bulacan etc., most of the soil consists of a heavy clay containing 20 % fine silt and 40 % clay with an adequate supply of humus. This type of soil however has been found advantageous to lowland varieties rather than to upland which require a good loam.

There has been much difference of opinion as to the use of commercial fertilisers, but experiments in the Philippines have shown that a ratio of 5 % nitrogen, 8 % phosphoric acid and 10 % potash is advisable and ammonium sulphate has been found the best form of nitrogenous fertiliser.

CULTURAL METHODS. — A description is given of the 5 general methods of planting viz. "cañigin" or mountain, dry or upland, "sabog" (palay broadcasted on the rice paddies), and tubigan (lowland).

As regards the methods of seedbedding the, "dry seedbed" method has been proved unsuitable, but the ordinary seedbed method (transplanting 30-40 days from sowing previously sprouted seed) has given good results, and also the so-called "dapog" system of covering with banana leaves by which it is possible to transplant seedlings at a much earlier stage than with the ordinary method. The ordinary system requires on an average 60 to 75 lb. of seed to plant a hectare and the dapog system 15 to 30 lb. more. This latter system is recommended for places where the palay is broadcasted on the paddies or where the planting season is well advanced. It is also advisable in growing early-lowland rice varieties during the regular season.

CROP ROTATION. — Although this is not usually practised, the planting of maize or beans especially the mungo (*Phaseolus mungo*) is advised.

DISEASES AND PESTS. — Until crop rotation, etc. is practised, the difficulties of controlling the locusts and cutworms (*Prodenia litura* and *Spodoptera mauritia*), rice bugs (*Leptocoris acuta*) etc. are bound to exist.

COST OF PRODUCTION. — The following estimates of the cost of production per hectare of the lowland, upland and tenant systems are based on the average cost of labour and actual experiments conducted at certain stations.

From the above estimates and calculating on the average for the 1919 crop of 24.48 cavans per hectare, the cost of producing 1 cavan of palay, taking the average of the 3 methods of planting, will be pesos 2.83 and pesos 5.66 for clean rice. The value of by-products will cover the cost of milling. It is estimated that 100 kg. of palay produce about 62 kg. of clean rice; 18 kg. of meal or broken grains, 14 kg. of hull and 6 kg. of "bran".

Estimated cost of production of rice per hectare, 1920.

Lowland		Pesos
Preparation of seedbed 400 sq. metres . .	1 man and animal daily . . .	1.50
One cavan seed palay	daily	5.00
Cleaning and fixing dikes . . . . .	. . . . .	0.80
Ploughing 1 hectare of land	7 men and 7 animals	10.50
Harrowing with "sayod"	4 " " 4 "	6.00
Lifting and distributing seedlings	2 " "	1.60
Transplanting	14 women	8.40
Care of crop; irrigating, weeding etc. . .	5 men	4.00
Harvesting with "ling cao"	10 "	8.00
Stacking and hauling sheaves	2 "	1.60
Threshing with "pioa" and winnowing . .	5 "	4.00
Rental of land . . . . .	. . . . .	20.00
Cost of 32 gunny sacks 0.40 peso each . .	. . . . .	12.80
<i>Total cost . . .</i>		84.20
Cost per cavan of palay produced		2.63

		Pesos
Seed palay, 35 gantas . . . . .	. . . . .	7.00
First ploughing	7 men and 7 animal daily . .	10.50
Second ploughing	5 " " 5 " "	7.50
Harrowing	2 " " 2 " "	3.00
Planting	1 man " " "	0.80
Weeding	8 men " " "	6.40
Harvesting with yatab	16 women	9.60
Threshing and winnowing	3 men	2.40
Rental of land . . . . .	. . . . .	10.00
Cost of 20 gunny sacks at 0.40 peso each .	. . . . .	8.00
<i>Total . . .</i>		65.20
Cost per cavan of palay produced		3.26

		Pesos
10 % depreciation of implements (plough and harrow) . . . .	. . . . .	3.00
15 % " of 1 carabao (= zebu) . . . . .	. . . . .	30.00
Harvesting threshing, landlord's share and used animals . . . .	. . . . .	6.00
<i>Total . . .</i>		39.00
Cost per cavan of palay produced		2.60

M. L. Y.

- 110 - **Rice-Growing in Messenia, Greece.** — CARDIKIS, J. J. (Departmental Agriculturist of Messenia), in *l'Economiste d'Athènes*, First year, No. 18, pp. 278-279. Athen., January 19-1 February 1922.

Rice-growing was introduced into Messenia in 1919 by the Departmental Bureau of Messenia. A preliminary trial was made on 4.5 *stremmes* (4500 sq. metres). The total crop obtained was 2,500 kg. of paddy. Next year, 1500 *stremmes* were sown, the yield for 1200 of which was 375 000 kg.

Rice cultivation has attracted the attention of the Government, and the National Assembly passed at its first reading a Bill granting a sum of 100 000 drachmas for the encouragement of the industry.

Messenia rice is superior as a food to the rice imported from abroad. Rice-growing could easily be extended to an area of 13000 *stremmes*, and with careful management of the water-supply which is sufficiently large, this area might be increased to 30 000 *stremmes* and the production might reach 15 000 tons with a value of 48 million *drachmas*.

Great advantages would accrue to the country from rice cultivation, which would be a source of wealth and bring about 350 000 *drachmas* into the Treasury in the form of State taxes. The regulation of the river Amisossos would contribute to the extended cultivation of other crops while the drainage of the Messenian swamps would free the country from malaria.

P. C.

- 111 - **What Amount of Phosphatic Fertiliser is necessary for Rice?** — NOVELLI, N. in *Giornale di Ricoltura*, Vol. XII, No. 2, pp. 20-22. Vercelli, February 28, 1922.

The author had analysed at the Laboratory of Agricultural Chemistry of the Royal Agricultural College in Milan, a sample of "Chinese origin" or "Abbondanza", a variety of rice which, together with other very similar types, is the kind most widely cultivated in North Italy. The straw was found to contain 0.40 % of phosphoric acid and the paddy 0.90 %. As the paddy and straw yield per hectare can be reckoned respectively at 60 quintals and 90 quintals, about 90 quintals of phosphoric acid (a substance in which most of the soils of the Italian rice-fields are generally poor), are removed by the crop. The analyses made by the author have shown that few soils contain more than 1 per 1000 of phosphoric acid; the best rice-field soils contain from 0.5 to 1 per 1000. Further the irrigation waters of the principal rice-growing districts of Italy are practically entirely deficient in phosphoric acid, which has therefore to be entirely restored to the soil by the manure.

Leaving a small margin to cover losses, this must be applied at the rate of at least 7 to 8 quintals per hectare of phosphatic fertiliser containing 15 % soluble phosphoric acid, $\frac{2}{3}$ of which should be harrowed in before the rice-field is flooded, and $\frac{1}{3}$ after the first weeding, when the rice-field is dried for the application of the nitrogenous fertilisers, this being a larger amount than is generally used. The author calls attention to the troubles arising from an insufficient quantity of phosphatic fertiliser; late ripening, susceptibility to disease, defective fertilisation and seed-setting.

F. D.

412 - Additional Notes on Adlay (*Coix Lacryma-jobi* var. *mayuen*), in the Philippines (1). — WESTER, P. J., in *The Philippine Agricultural Review*, Vol. XIV, No. 2, pp. 159-177. Manila 1921.

The previous article (1) with reference to the general cultivation and commercial value of the adlay (*Coix Lacryma-jobi* var. *mayuen*) was written before the actual milling and baking tests had been made. The author here reports the information since accumulated.

It has been demonstrated that adlay forms a palatable and whole some food and according to the data collected it appears that a mixture of equal parts of adlay and wheat flour or $\frac{2}{3}$ adlay to $\frac{1}{3}$ wheat, would be equivalent for all practical purposes to an equal quantity of wheat flour, except that it is slightly richer in fat. The nutrient value of adlay in comparison with other cereals and pulse crops is of decided interest: adlay (average of 8 samples tested) 95.4, wheat 87.4, maize 91.2, rice 88.3, oats 80.6.

The great advantage of adlay over rice is that it is possible to grow and harvest with machinery, which is impossible for rice paddies.

With lowered cost of production and an improvement in quality of grain etc, adlay would appear to be destined to supplant rice as the leading staple grain over considerable areas.

The previous rejection of adlay as a staple food may be attributed to peculiar features which have made it inferior to rice as grown by a primitive people, rather than to any intrinsic inferiority in the grain. The advent of modern machinery etc. has removed these objections.

It is interesting to note also that although the long growing season is admittedly a drawback, this is balanced by the fact that adlay is less subject to attacks of locusts than rice and maize and the rice bird and wild pigeon also appear less destructive. This is true also of the rice bug *Lepidocoris acuta*, one of the two most destructive insect pests of the rice plant

M. L. Y.

413 - Alimentary Value of Some Indo-Chinese Leguminosae. — PRUDHOMME, R. in *L'Agriculture Coloniale*, Bulletin mensuel de l'Institut National d'Agriculture Coloniale, Year 6, No. 50, pp. 33-41. Paris, February 1922.

The author, after referring to the importance of the importation of dried vegetables from the Colonies to France, describes the various Leguminosae cultivated in Indo-China:

1) PURPLE DOLICHOS (Dâudo) (*Dolichos* var. undetermined) — Its chemical composition is as follows: Water 11.98%; ash 2.86%; fatty substances 1.10%; nitrogenous substances 24.08%; sacchariferous substances 41.8%; crude fibre 6.72%. The natives cook it like ordinary rice; it can be compared to kidney-beans, lentils and common vetches.

2) FRENCH BEAN (Dâu-xanh) (*Phaseolus radiatus*). — This is much the most important of all the Leguminosae. Its chemical composition is as follows: Water 12.10%; ash 3.12%; fatty substances 0.64%; nitrogenous substances 25.40%; sacchariferous substances 42.86%;

(1) See R. JUNE 1921 No. 625. (Ed.)

crude fibre 7.84 %. When ground it is used in Annam for making a kind of vermicelli (known by the name of « Songthân »; about 80 000 kg. of which are manufactured and exported to China. This vermicelli differs greatly from that consumed in Europe. It contains a much smaller quantity of nitrogenous and fatty substances but its crude fibre content is higher. Further its composition varies greatly in different samples. The vermicelli contains 25 % less nitrogenous and mineral substances and much more sacchariferous substances than the beans from which it was made.

These beans are much appreciated as a vegetable after germination, and are eaten when the stalks are from 8 to 10 cm. in length. They are a common article of diet among the European population of Indo-China. They crop easily if previously soaked in water for about 12 hours (after which they cook in 40-60 minutes). When boiled they much resemble lentils and have a clean pleasant taste. This *Phaseolus* presented on analysis only slight traces of glucosides; it is entirely free from cyanogenetic glucosides, alkaloids, and glucosides poisonous to mice.

3) SPOTTED DOLICHOS (Dầu-truong-quốc) (*Dolichos tonkinensis*); Chemical Composition: Water 11.02 %; ash 3 %; fats 1.34 %; nitrogenous substances 23.35 %; sacchariferous substances 38.30 %; crude fibre 8.96 %.

VIGNA SINENSIS (Dầu-den-kouta-long) — Chemical composition: Water 12.14 %; ash 3.08 %; fats 1.14 %; nitrogenous matter 24.5 %; sacchariferous matter 43.36 %; crude fibre 7.92 %.

WHITE DOLICHOS (Dầu-trắng). These three beans can be used in the same manner as the purple Dolichos. All of them need 120 minutes boiling after soaking for 12 hours. They are superior in quality to our ordinary French beans, but not as good as *Ph. radiatus*. Their use is to be recommended both as an article of human diet and as a cattle feed.

4) SOY-BEAN — This is a well-known plant and is only mentioned by the author.

To sum up, *Phaseolus radiatus* is the species most suitable for human consumption, though the purple, black and spotted varieties of Dolichos can also be used. The white Dolichos and the soy-bean are chiefly fed to stock.

P. C.

114 - The new Chinese Variety of Lucerne in South Africa. — DONKIN, J. E., in the *Journal of the Department of Agriculture Union of South Africa*, vol. III, No. 3, pp. 257-258. Pretoria, Sept. 1921.

FAIRCHILD, the "Agricultural Explorer" of the United States Department of Agriculture, found in Tibet, at a height of about 1200 feet above sea level, a new variety of lucerne growing on the edge of a swamp. This variety has been tested for a period of five years at the School of Agriculture of Grootfontein near Middleburg, Cape Province, where for purposes of comparison it has been grown side by side with six other well known types.

Although during the first period of growth this "Chinese" variety as it has been called, could not be considered as equal to the "Provence"

and "Tamworth" types, owing to thin seeding in the two last years of the test it gave hay crops almost equal to those of "Provence" and superior to those of "Tamworth". Observations taken seem to show that "Chinese" lucerne is a hybrid and several variations in stalks and leaves etc. are noted. It is a heavy cropper and particularly resistant to frost.

If grown for seed, 1 oz. is sufficient for a row 100 yards long, which in the second year should produce enough seed for one acre; this should in turn produce a sufficient quantity of seed for sowing broadcast several acres every year.

M. L. Y.

415 - Experimental Trials in Natal with "Hubam Clover" a new Variety of *Melilotus alba* var. *annua*. — HALL, W. S., in *Journal of the Department of Agriculture, Union of South Africa*, Vol. III, No. 5, pp. 463-465. Pretoria, Nov. 1921.

The utility of the annual white sweet clover (*Melilotus alba* var. *annua*) as a forage crop and as a legume in short rotations has been the subject of much attention lately in the United States and in Canada.

The Iowa strain of seed, introduced by H. D. HUGHES of Iowa University, has recently been tested at the Cedara School of Agriculture and Experiment Station, Natal (S. A.), and the variety known as "Hubam clover" has proved a distinct success.

The plant is recommended as a forage crop, but stock should not be allowed to pasture immediately after rain or heavy dew. Although some animals do not appear at first to appreciate its bitter aromatic taste, they soon acquire a liking for it if fed constantly on Hubam clover. Its feeding value compares favourably with other legumes.

In appearance, "Hubam clover" resembles the biennial form of *melilotus* except that it is somewhat smaller, the root is more woody and crown or resting buds are not formed. The stems, branches, leaves, flowers pods and seed are indistinguishable from the biennial form.

It has been ascertained by tests made in the United States that the percentage of biennial plants raised from annual seed varies from 1 to 8.

The seed possesses a hard coat and consequently germination is slow unless the seed is scarified and thus enabled to absorb the necessary moisture more readily. Scarified and unscarified seed give a germination percentage of 90 and 30 respectively. A special machine has been invented at the Iowa Agricultural College for this purpose known as the "American Hulling and Scarifying Machine".

Soil moisture is necessary; only moderate results are obtained on acid soils, although rather more satisfactory than is the case with lucerne; better results are obtained on alkaline soils.

When the plant reaches a height of 30 in. before the blooming period, it may be cut and cured as hay though it is essential to preserve the leaves carefully. As soon as the plant is wilted, cocks should be made immediately, and left until the stems are cured. It may be ensiled if cut in the early stages before the stems have become woody.

Further tests are being carried out in order to ascertain the agricultural value of this plant in South Africa.

M. L. Y.

6 - **Cotton-Growing in Algeria** (1). — FOURNIER (Head of the Experiment Station at Ferme-Blanche, Oran), in *Revue agricole de l'Afrique du Nord*, Year 20, No. 128, pp. 26-29, 2 photographs. Algiers, January 13, 1922.

The author gives an account of the results obtained on the estate of Habra and de la Macta, near Perrégaux. In 1910 the average cotton crop was 13.8 quintals per hectare, which represents about 4.5 of cotton fibre for the varieties Yanovitch and Abassi. The net profit was 745.65 francs per hectare.

The 1920 results are distinctly higher: the "Yuma" and "Californie" varieties derived from the Egyptian variety, "Mitafifi", produced 23 quintals of unginned cotton per hectare. The later-maturing varieties on the neighbouring estates only produced 5.5 quintals per hectare. The land of the Experiment Station had been dressed with 40 quintals of well-rotted dung and 40 quintals of bat guano per hectare.

The pickings succeeded one another without interruption from August to the end of November.

The receipts per hectare were 7068.80 fr. and the expenses 2 525.85 fr. therefore the net profit was 4 544.95 fr. per hectare, or 6 times larger than in 1910.

At the present time there are 300 hectares under cotton in the Orléansville district.

The varieties selected by Dr. TRABUT, Director of the Botanic Service, Professor of the Agricultural Institute of Algeria, produce bolls that can be gathered before the heavy rains set in. Their yield is satisfactory, and they are much earlier than "Yuma," or "Californie". The author adds that the cotton-plant can bear relatively large quantities of salt. P. C.

7 - **Irrigation Schemes in the Niger Territory of the French Soudan and the Extension and Improvement of Cotton Production.** — I. LELUC, J., *Le coton du Soudan et les grands projets d'irrigation* in *L'Avenir Textile*, No. 9, pp. 9-11 Guebwiller (Haut-Rhin), July 1921. — II. HÉLO (Secrétaire général du Comité du Niger), *Les irrigations du Niger et la culture cotonnière au Soudan*, in *Renseignements Coloniaux et Documents publiés par le Comité de l'Afrique française et le Comité du Maroc*, pp. 127-220 Paris, Oct. 1921.

I. II. — Up to the present time cotton has been cultivated in the French Soudan over an area of more than 150 000 sq. km., but the irregularity and short duration of the local rains has resulted in inferior quality and poor yield. With the object therefore of introducing and developing varieties with medium and long fibres and extending the cultivated area, schemes have been put forward to systematise and establish regular irrigation and the utilisation of the floods of the river Niger which occur at certain times of year propitious to cotton development. For example, during 200 days (June to January), the Niger distributed more than 400 cub. m. per second, and it is estimated that this would serve to irrigate a cotton area varying from 400 000 to 500 000 hectares *i. e.* 1 200 000 to 1 300 000 hectares on a triennial rotation system.

(1) See *R. Mar.* 1917, No. 243; Aug. 1918, No. 865; Oct.-Dec. 1919, No. 1138. (Ed.)

According to the remarkable Scheme prepared by the hydraulic expert BÉLIME, it will be possible to obtain as a result of methodically established irrigation, first quality cotton ranking with the best known varieties, *Sa kallaridis* etc., as well as remunerative yields. It is a recognised fact that Cambodia, Algeria and Senegal etc. yield a considerable quantity of cotton, but it is now considered evident that the most valuable area will be in the Niger valley.

The authors give an outline of the programme of proposed irrigation work, the lines of canals etc.

M. L. Y.

418 - **Cotton Growing in Queensland.** — BOYD, A. G., in *Queensland Agricultural Journal* Vol. XVII, Pt. 1, pp. 32-34. Brisbane, Jan. 1922.

Distinct advances have been made quite recently in connection with the extension of the cotton areas in Queensland. Very favourable reports as to the future possibilities of this country, have been presented by VAUGHAN (Ex-Premier of South Australia) who states that the British Government has set aside a sum of £1 000 000 for the encouragement of cotton growing within the Empire, a portion of which would be devoted to the establishment of the industry in Queensland. Up-to-date machinery (cotton gins etc.) has been imported for use with the next crop, which is expected to be a comparatively heavy one.

A short time ago VAUGHAN secured cotton samples from different districts and submitted them to English cotton brokers for inspection. Opinion was unanimous that the samples possessed all the best qualities of the more valuable cottons of other countries (probably including America, Egypt, Africa and India), in respect of length, strength of fibre, colour, etc.

Up to the present, practically all the inland areas have been cultivated with the Uplands variety (short staple), and the Sea Island type has been limited to coastal areas. It is proposed however to use sea Island on a much larger extent inland next year, as the long-staple is of great commercial value.

An important point in favour of Queensland as a cotton producer is that the plant is almost entirely free from the diseases which cause so much damage in the cotton districts of the United States and Egypt.

M. L. Y.

419 - **New Fibre Crops in the Belgian Congo, and their Industrial Value.** — GOOSSE (Directeur du jardin botanique d'Étala), in *Bulletin Agricole du Congo Belge*, Vol. X No. 3, pp. 622-623. Brussels, Sept. 1921.

The Jardin botanique d'Étala has recently carried out a series of observations under the direction of CORBISIER with a view to ascertaining the respective values of various fibre plants, both native and imported.

The annexed Table shows the results of the investigation. It is stated that although the imported varieties do not appear to adapt themselves readily to equatorial conditions, excellent results have been obtained in the Lower Congo (Ganda-Sundi and Congo da Lemba).

[417-419]

Results of the Cultivation of Textile Plants in the Belgian Congo.

Name of plant	Weight of stems	Period of retting	Weight of fibre	No. of days of work	Time required to produce 1 kg. fibre	Net cost 1 kg. fibre	Yield
	kg.	days	kg.	days	days	frs.	%
<i>Urena lobata</i> var. <i>reticulata</i> (Kuluende)	615.3	15	49.88	57.00	1.15	0.86	7.95
<i>Urena lobata</i> (Lotiti muindu.)	638.4	20	36.00	58.87	1.68	1.26	5.64
<i>Triumfetta cordifolia</i> (Bekongue) . . .	1517.5	15	70.235	70.8	1	0.75	4.61
<i>Cephalonema polyanthum</i> (N'dolo n'kongue)	1580.0	20	76	83.7	1.10	0.82	4.81
<i>Honckenia ficifolia</i> (Bonkongue n'inga)	666.5	22	33.280	111.3	3.34	2.50	5.00
<i>Mannisphyton africanum</i> (N'kossa)	785.0	—	25	134	5.36	4.02	3.18
<i>Agave rigida</i> var. <i>sisalana</i>	300.0	—	11	65	5.90	4.42	3.66
<i>Posneroya gigantea</i>	880.0	—	14	120	8.57	6.42	1.50
<i>Sansevieria guineensis</i>	14.0	—	0.190	—	—	—	1.35
<i>Sansevieria cylindrica</i>	14.0	—	0.150	—	—	—	1.07

The stems of *Mannisphyton africanum* are not retted, but they are aped immediately after cutting, and exposed to the sun, and after a v days, the fibre is extracted by thrashing.

It has been noted that the period of retting is regulated according to a stage of maturity of the stem; the type of soil also plays an important rt in this process.

Although the actual quality of the fibre is not of equal value to that the imported species, attention is drawn to the fact that certain native ecies, especially *Urena lobata*, can be utilised advantageously as a source fibre at a comparatively low cost. M. L. Y.

o - The Possibilities of Developing the Roselle (*Hibiscus Sabdariffa* var. *altissima*) Fibre Industry in the Federated Malay States. — SOUTH, F. W., in *The Agricultural Bulletin of the Federated Malay States*, Vol. IX, No. 1, pp. 23-26: Kuala Lumpur. Jan.-Mar. 1921.

As a result of the small scale experiments carried out by MATHIEU : Kuala Kangsar, with *Hibiscus Sabdariffa* var. *altissima*, the following conclusions may be drawn:

This plant appears to adapt itself readily to prevailing conditions in 10 Federated Malay States.

The lateral branches when cut at the right age (i. e. when the plants 10 just beginning to flower and when if properly developed, the branches would be over 4 ft. long), should give a good quality long staple fibre, suitable for spinning. Reports from the Imperial Institute, London

confirm this statement. On the other hand if the branches are cut when too old, the fibre is found to be matted and consequently of inferior quality.

Fibre from the *main* stem is however of inferior colour, appearance and quality and the staple is shorter and is in fact of no value commercially.

The plants seed fairly freely but are liable to attack by the cotton stainer *Dysdercus* spp.

Further experiments are in progress to determine the best planting distances to adopt, and also to obtain a large supply of seed of both the red and the green varieties. Seed is being distributed to various plantations for test purposes.

The work in general is as yet at an early stage and investigations are still necessary with reference to cost of production, methods of cultivation etc.

M. L. V.

421 - The Quality of the Rubber of *Hevea brasiliensis*; its Variations and their Causes, Economic Importance for the Amazon Rubber Industry. — CAYLA, V. (Professor of General Agriculture). In *Archivos da Escola Superior de Agricultura e Medicina Veterinária*, Vol. V, Nos. 1 and 2, pp. 71-96. Niteroi (E. do Rio), Sept. 1921.

A factor frequently introduced into the very complex question of rubber production, which is of paramount importance to Brazil, is the quality of the product, that is to say its market as apart from its intrinsic quality.

For manufacturers or producers, there is nothing absolute in the quality of rubber which can however be determined scientifically from its physical and chemical constants, as has been shown by the valuable, exhaustive and accurate laboratory experiments systematically made by the Dutch since 1910.

Hitherto the commercial determination as carried out, for instance, by the brokers has been accepted. This determination was based on external characters: form, appearance of surface, colour, smell, appearance of a single section, elasticity determined roughly by pulling a sample between the hands etc. These observations can only furnish very incomplete information, and are useful only to expose 1) the grossest frauds; 2) the state of the preservation of the rubber; 3) its geographical origin.

The quality of rubber can be approximately determined by: 1) the quantity of coarse, visible impurities (decrease in useful weight); 2) the presence or absence of diseases: moulds, and especially stickage, which causes bad vulcanisation; 3) the knowledge acquired by long experience of the various kinds of crude rubber according to their origin, botanical source, processes of coagulation, drying etc.

In scientific determination, the Dutch systematic researches take into account: 1) the chemical analysis of the crude rubber (the water, resin, ash and nitrogenous substances present together with the acidity); 2) the physical constants: viscosity of the rubber solutions; vulcanisation coefficient; mechanical test of vulcanised rubber; tension test; degree of elasticity; of elongation (permanent deformation etc.).

In the present condition of knowledge on the question, it remains necessary to accept the definition of the producers and dealers; rubber of good

quality is clean, sufficiently dry, sound, well preserved and not very variable. The dealer indeed only reflects the wishes of the manufacturer, and the latter prefers the rubber that suits him best and will pay a higher price for it. He requires that the rubber shall be:

1) Clean and sufficiently dry to reduce loss in washing, which, when considerable, increases the loss in weight of the raw material, necessitates more labour and makes greater demands on the apparatus and the fuel driving the machines;

2) Sound, because sticky (*i.e.* resinous) rubber contaminates the pure product, vulcanises badly and also entails loss;

3) In a good state of preservation, for any deterioration means a loss of useful material, and owing to the mode of preparation of crude rubber, it is more or less liable to spoil.

4) As little variable as possible; this is necessary, because all the treatments to which rubber is subjected in the factory are empiric, and with an invariable rubber the formulae need not be altered.

It is necessary also to mention the preference given by manufacturers to certain rubbers for reasons unknown to dealers or producers, which they are unable to detect.

The author deals with the grounds of this preference in the case of *Hevea brasiliensis* rubber in Brazil, and in the plantations of the Middle-East. Since competition has arisen in the markets of the world, the manufacturer is always willing to pay a higher price for "Para hard core" than for "white crepe first latex" (which are the two best qualities), without taking into consideration the fact that "Para" loses 18 to 20% in washing and "Plantation" 2% at the most.

The author is, however, of opinion that this difference in the prices quoted which has prevailed for twenty years, though no doubt it has now decreased, has sufficed to insure that Para rubber is still really superior in quality to "Plantation".

This difference in quality has been attributed to three causes: 1) the origin of the trees; 2) the age of the trees; 3) the preparation process to which the raw rubber is subjected. The author draws the following conclusions from his examination of the question.

1) The origin of the trees cannot account for the difference in the American and Asiatic products;

2) the effect of age upon trees ready for tapping is very slight and quite insufficient to explain the difference observed;

3) although it is impossible to adduce actual proof, it would appear that the principal cause of the difference in the quality of "Para fina" and "first latex" undoubtedly lies in the method of preparation.

After discussing the alleged defects of the commercial varieties of both "Para" and "Plantation" rubbers, the author expresses his belief that both could be improved. For Brazil the practical lesson to be drawn from this fact is that with sufficient care, "Plantation rubber" could be made as acceptable to the manufacturer as "Para fina".

The author believes that the improvement of Brazilian rubber is to be sought in the reduction of the net cost for: a) eastern competitors can improve their rubber until it is practically equal in quality to "borracha"; b) since Brazil no longer controls the market, she cannot fix the price of rubber merely by supplying rubber of better quality; c) only taking into account the exceptional quality of the product would mean reducing the amount exported to a very insufficient quantity. This does not mean that the quality of the rubber should be sacrificed. On the contrary it is necessary: 1) to keep the manufacturing quality equal or superior to that of the eastern rubbers; 2) to improve the commercial quality by more careful preparation and the suppression of adulteration.

In fact the reduction of the water and of the impurities to 2% in weight is equivalent to reducing the cost price, since with "borracha" in leaves coagulated by "defumação", it is possible to obtain on the European markets a plus-value of 14% as compared with the price of the balls. The leaf form has the following advantages over the balls: 1) with equal weight, a plus cash value of 14%; 2) freight paid for 2% of impurities instead of for 20%; 3) export dues paid on 2% of impurities instead of on 20%.

In short, the author is of opinion, that the difference in the quality of the two *Hevea* rubbers, the Brazilian and the Indo-Malayan, is almost entirely due to differences of preparation; that it is decreasing, and may disappear altogether. He also believes that, since the manufacturers recognise that the quality of the best Amazonian product is equal or superior to that of "crepe first latex", it is only necessary to maintain this quality. Further that for economic reasons, it would be advisable to improve the commercial quality of "Para fina", as its quality must not be relied upon as the sole means of solving the "borracha" crisis.

G. A. B.

422 - Investigations made in Java Concerning the Origin of the Latex of *Hevea brasiliensis*. — BOBILIOFF, W., in *Archief voor de Rubbercultuur in Nederlandsch-Indië*, Year. 5, No. 3, pp. 95-111, figs. 5. Buitenzorg, March 1921.

Different methods of tapping *Hevea brasiliensis* were carried out with a view to making direct observations as to the exact origin of the latex and to ascertain the direction of the flow and the effect of grafting a species having a yellow latex on another having a white latex.

The results obtained from this investigation may be summarised as follows:—

1) The change of colour of the latex from yellow to white in the neighbourhood of the tapping cut which gives a yellow latex, makes it possible to control the extraction sphere of latex when tapped. The appearance of white-coloured latex at places where previously the yellow colour was present indicates that these places are exhausted and that secondary latex-building is taking place.

2) The flow of latex to the tapping-cut is very slow and about 2½ months is required to cover a distance of about 1 metre.

3) The extraction by ordinary tapping from above downwards occurs only from the latex vessels which lie underneath the cut and about 1 cm. on each side of the cortex.

4) The extraction of latex by tapping from below upwards is slightly less than by the reverse method.

5) If the cut is high above the ground, the latex is extracted also from the roots, but only from the places lying below the cut or in the vicinity. In this case the latex is extracted from the side roots, but only from those under the tapping cut.

6) Above the tapping cut there is no extraction of latex by ordinary tapping.

7) Three year old grafted trees from a common parent with yellow latex grafted on stock with white latex continued to give the yellow latex and the new stock white latex.

M. L. Y.

[23] - **Sugar Beet Cultivation in Louisiana, United States.** — COATES, E. C., and KIDDER, A. F. (Louisiana State University, Baton-Rouge, Louisiana) in *The Journal of Industrial and Engineering Chemistry*, Vol. XIV, No. 3, pp. 213-214, Washington, March 1, 1922 (1).

A long series of experiments have proved that it is possible to grow sugar beets, of high sucrose content and purity combined with great productivity, in Louisiana and presumably also in the other southern States of the Confederation. The best results are obtained by late spring planting. The yields averaged 18 tons per acre, the weight of the beets was 1.5 to 2.5 lb., the purity about 85 % and the sucrose 14 %. In order to obtain such results it is, however, necessary to use good seed which breeds true to type. Seed grown in the United States to-day fulfils this requirement and appears to be even better than European seed.

The first experiments in sugar-beet growing were made by one of the authors in 1898, at the Louisiana State University, with seed imported from Europe and sown in November; afterwards sowings were made in August, and mature roots obtained in February. Under these conditions beetroots can be matured in May, June and July, and probably also during March and April. The tonnage per acre in Louisiana is probably heavier than elsewhere, and the sucrose and purity are high enough for commercial purposes, while the cost of cultivation is much less than in most beet-growing sections, being from 15 to 20 dollars per acre.

A series of analyses shows that beets after harvesting will keep for a week or more without appreciable loss in sucrose or purity. These results are probably too favourable, but it is reasonably certain that, after harvesting, beets in Louisiana will not deteriorate more in May, June and July than sugar-cane in Cuba during the same months.

Beets planted on January 24 are ready for harvest by May 8 and probably earlier; they can, however, be lifted in good condition until July and even later. If beets could be matured early, they could be worked

(1) it should be noted that in the district in question, the sugar-cane is grown to its climatic limit. (Ed.)

into sugar in Louisiana and thus extend the sugar season for 3 months or longer. This would double the value of the sugar factories which normally can only run for about 2 months in the year. G. A. B.

424 - **Wild Beets: Composition and Value.** — See No. 391 of this *Review*.

425 - **The Possibility of Growing Tea in Italy.** — CAVARA, F., in *Bollettino dell'Associazione Italiana Pro piante medicinali, aromatiche ed altre utili*, Year IV, Nos 7 and 9, pp. 106-1 and 133-138. Milan, 1921.

Long experience has already proved that the tea-plant can grow certain parts of Italy; it has been successfully cultivated in the Botanic Gardens of Pavia (by putting it under cover during the winter), Florence, Pisa and Naples, and also in the Borromean Islands on Lake Maggiore et

According to the opinion both of the author and CARNEL, there exist in South Italy, Sardinia, and Sicily very sheltered shady valleys where tea could be cultivated. BECCARI was of opinion that the tea plant would thrive in Italy in the olive zone, where it could, if necessary, be grown beneath the olive-trees or vines, and thus obtain a little shade. It has been proved, however, that the dry maritime climate of the Mediterranean does not suit tea and that this is the reason of the failure of several experiments in growing the plant in Sicily.

Twenty years ago the author distributed as an experiment some young tea plants to several landowners from Tuscany to Calabria. As it was a question of a new crop with special requirements as to temperature and atmospheric and soil moisture (the tea-plant cannot stand lime), it is not surprising that most of the trials failed. In one case however on an estate in the commune of Bagni di San Giuliano (Prov. of Pisa), all the plants struck root and grew, producing after some years both flowers and fruits and very fragrant beverage was made from the leaves. The author strongly recommends the renewal of these experiments. They could also be made in some suitable parts of Eritrea and Somaliland. F. D.

426 - **Manuring Coffee.** — I. Manures for Coffee Plantations, in *Royal Botanic Garden Kew, Bulletin of Miscellaneous Information*, No. 9, pp. 347-349, bibliography, London, 1921. — II. Coffee in Guatemala and Costa-Rica, *Ibidem*, pp. 346-347. — III. HERMANN, J. A., *Cafecultura e os adubos*, in *Annaes da Sociedade Rural Brasileira* No. 17, pp. 1043-1050. São Paulo, November 1921 (1).

The effects of the application of chemical manures to Coffee plants have not been studied for a sufficiently long period to justify their recommendation for general use.

Such active artificial manures as sulphate of ammonia, sulphate of potash, nitrate of soda, superphosphate etc., are undoubtedly of value for annual crops where immediate results are desirable and the temporary character of the fertiliser is of secondary consideration, but for coffee or any other perennial plant where a slower and more lasting effect is required a similar value has not been established. In fact Sir John LAWES has

(1) See *R. Jan.* 1915, No. 48. (*Ed.*)

ated that "most decidedly the active artificial manures would not be suitable for the coffee-tree", but considerable difference of opinion on the point seems to prevail in all coffee-growing countries.

The manures, however, that can be safely recommended are those of an organic character, including prunings, leaves, weeds, coffee pulp and other refuse obtained in the preparation of the coffee-bean, farm-yard manure, green-manures, bone, dried blood, oil-seed cake, guano and fish manure, to which may be added the organic substances, wood-ashes and lime. The use of farm manures and green manures may not be practical in all plantations, but the suggestion of rotting down straw to take their place deserves consideration. As wet straw alone will not rot down, and some active form of nitrogen is required to start the process, this may be supplied by the urine from stock, or by passing sewage through a filter-bed made of straw (1).

The selection, however, of any of the manures mentioned can only be decided as a result of knowledge of local conditions and after experiment, or it must be based on convenience and cost.

A manure of considerable value may be made by mixing coffee-pulp with bone-meal (in the proportion of about 1 part of bone-meal and 20 parts of coffee-pulp), together with any general refuse from the plantation, heaped and buried for several months in a place where there is protection from sun and rain. When sufficiently decomposed the manure may be dug in round the trees, without injury to the roots if possible, or laid on as a mulch. The pulp together with the parchment and other refuse from the factory is valuable on account of the nitrogen, phosphoric acid, potash and lime it contains, while the bone-meal is useful as supplying phosphoric acid, lime and nitrogen. The percentages in the coffee-pulp of these constituents are considerably higher in material when fresh than after exposure for several months to sun and rain, and it is important to preserve it as above described. Any wood-ashes that may be available from burning rubbish in the plantation can be put into the manure heap to increase the supply of potash. As tropical soils are often deficient in lime, slaked lime can when necessary be distributed over the whole plantation before applying the mixed or other manures, at the rate of about 15 cwt. per acre, or with trees 3 ft \times 3 ft, this would be approximately 3 lb. per tree.

TABLE I. — *The annual requirements for 1000 Coffee Plants (at different ages) of nitrogen, potash, and phosphoric acid.*

Age of tree	Nitrogen	Potash	Phosphoric acid
	lb.	lb.	lb.
Up to 4 years	9.87	23.62	2.49
From 5 to 8 years	35.7	76.92	19.57
From 9 to 20 years	28.87	45.83	15.76
Over 20 years (old trees)	5.09	30.53	9.48

(1) See R. March 1922, No. 236. (Ed.)

II. — As regards the manuring of coffee-trees in Guatemala and Costa Rica, it is stated that coffee has been grown in these countries for nearly a century upon soil characterised by its high humus content, for the plantations occupy the site of original forests and much leaf-mould is produced by the plants and the shade trees. There is, however, a clear need of manure for the soil is usually deep and sometimes stony. Lime and natural manures are recommended in preference to artificial manures.

III. — The author of the 3rd publication states that a large number of the old coffee plantations in the State of São Paulo of Brazil show signs of degeneration owing to neglect for several decades and especially to insufficient supplies of humus and lack of regular manuring. The author estimates that a crop of 750 kg. net of coffee has been obtained per 1000 trees during the last 10 years from the 800 million trees in bearing. The amount of nutritive substances removed from the soil is given in Table II. In order to replace these elements, it would be necessary to apply the natural or artificial manures given in Table III, but these quantities would have to be doubled or trebled in order to restore the plantations to their original condition.

TABLE II. — *Exportation of coffee from the State of São Paulo from 1850-1919 with the amount % of fertilisers extracted annually.*

Coffee Exports		Fertilisers extracted annually					
in the 10 year periods	Annual average in thousands of bags	in the ash					
		Nitrogen	Total ash	Phosphoric acid	Potash	Lime	Magnesium
		1.75 %	2.84 %	12.53 %	68.25 %	6.15 %	11.11 %
		tons	tons	tons	tons	tons	tons
1850-59.	2 500	2 625.0	4 260.0	578.9	2 779.7	260.7	468.
1860-69.	2 835	2 976.8	4 830.8	605.3	3 152.1	295.7	531.
1870-79.	3 675	3 858.8	6 262.2	784.7	4 086.1	383.3	686.
1880-89.	5 473	5 749.7	9 326.0	1 168.6	6 085.2	570.8	1 025.
1890-99.	7 226	7 587.3	12 313.1	1 542.8	8 034.3	753.6	1 354.
1900-09.	9 027	9 374.2	15 375.2	1 926.5	10 032.3	941.0	1 691.
1910-19.	9 821	10 312.1	16 735.0	2 101.7	10 921.0	1 021.4	1 837.
Average per bag. kg.		1.050	1.704	0.214	1.114	0.104	0.187

In order to find out whether it would pay to improve old coffee plantations the author carried out experiments, in 1913, on a 60 to 70 year old plantation belonging to the " Instituto Agronomico do Estado de São Paulo (Campinas) on 6 series of plots: A) control plots, without manure, but ploughed and pruned; B) 28 kg. of farmyard manure per tree; treated otherwise like A; C) 17 kg. fresh coffee pulp per tree; treated otherwise like A; D) 0.56 kg. superphosphate + 0.2 kg. potassium chloride + 0.2 kg. ammonium sulphate per tree; treatment otherwise as for A; E) 7 kg. farmyard manure + 0.15 kg. basic slag + 0.075 sulphate of potash +

065 kg. of nitrate of soda per tree, treatment otherwise as for A. The manures were applied 3 times, viz., in 1913-1914, in 1914-1915 and in 1916-1917. Table IV gives the results obtained after 8 years of experiment-

TABLE III. — *Quantities of Manures necessary to replace the substances removed from the soil.*

Ten year Periods	Farmyard manure annual average	Chemical fertilisers		
		Chloride of potassium containing 50 % potash	Nitrate of sodium containing 16 % nitrogen	Basic slag containing 16 % phosphoric acid soluble in citric acid
	tons	tons	tons	tons
150-59	550 930.0	5 559.3	16 406.3	3 559.2
160-69	630 426.6	6 304.3	18 604.6	4 035.2
170-79	817 217.0	8 172.2	24 117.2	5 231.0
180-89	1 217 042.0	12 070.4	35 916.6	7 790.3
190-99	1 606 859.4	16 068.6	47 420.6	10 285.5
200-09	2 006 859.4	20 064.6	59 213.4	12 843.4
210-19	2 184 190.4	21 842.0	64 450.6	14 017.3

TABLE IV. — *Yield of cleaned coffee per thousand plants.*

	Before the 1913 trials	Average for the 8 years 1914-21	
		Yield	Excess due to manuring
%ot A	184 litres	585 litres	— litres
• B	202 "	1229 "	644 "
• C	80 "	1228 "	642 "
• D	130 "	1452 "	914 "
• E	155 "	922 "	338 "

From these results the cultivation expenses for 1000 plants can be calculated.

TABLE V. — *Cultivation experiments for 1000 trees (in francs at par).*

	Total receipts 1914-1921	Total cost 1914-1921	Gross returns		Value of trees, cost of improvements and material	Average annual interest
			1914-1921	annual average		
%ot A	10 601.87	7 765.34	2 836.53	354.75	4 106.40	8.63 %
• B	24 860.99	11 239.07	13 621.92	1 702.74		41.46
• C	27 511.49	13 419.71	13 991.78	1 748.97		42.59
• D	28 371.26	10 474.43	17 896.83	2 237.00		54.48
• E	19 150.55	9 896.71	9 253.84	1 156.87		28.17

It is also interesting to know the condition of the different plots. This is shown by Table VI.

TABLE VI. — *Number of productive trees per 1000.*

	Before the application of the manures — 1913	8 years average — 1914-1921	In the last year — 1921
Plot A	825	748	670
„ B	480	845	770
„ C	110	946	930
„ D	240	743	590
„ E	620	914	900

The author estimates that the minimum return a good cultivator should obtain from a coffee plantation is 28.17 %, the amount produced by the plots of series E. G. A. B.

427 — *The Cocoa Industry of Ecuador and Possibilities of Introducing certain Varieties into Other Countries.* — TUDHOPE W. E. D. (Director of Agriculture, Gold Coast) in *Bulletin of the Imperial Institute*, Vol. XIX, No. 3, pp. 348-360. London, 1921

Report of investigations made chiefly in connection with the "Arriba" cocoa which constitutes over 50 % of the total export of cocoa from Ecuador.

The variety grown is almost exclusively that known as "Cacao Nacional" which possesses large pods weighing as much as 3 ¼ lb. and containing a large quantity of well formed beans; the seed contents of a number of pods examined, ranged from 40 to 51 (average per pod 44). This is evidently a superior type and produces on an average, 1 lb. of cocoa per 7 pods.

In the "Arriba" Province some fruits ripen every month of the year, though there are only 3 recognised crop seasons viz. February to June, July to October, and November to January.

During recent years Venezuelan varieties have been planted to a certain extent, as they have the reputation of giving a heavier yield and of maturing earlier than the former type, but apparently the Monilia disease has proved more virulent with these newly tested varieties, and apart from the fact that the trees do not grow so tall and big as the Cacao Nacional and therefore overcrowding is avoided, the superiority question is still open.

Practically all the cocoa exported is merely dried in the sun, a process which under ordinary conditions only requires 7 days.

The author considers that if the beans are given only a slight fermentation in mass before drying, more satisfactory results might be expected. Apparently in Ecuador only a very light fermentation is necessary to produce the desirable "chocolate break" in the dried bean. It may be con-

cluded that the beans are of superior quality to those for example of the Gold Coast, where it is reported that 6 days fermentation in boxes is necessary before even sun-drying is employed, in order to produce a similar chocolate break in the bean. The cocoa bean with the lightest coloured testa possible has the highest commercial value but it does not follow that this is "unfermented cocoa" in the Ecuador types. If drying is unduly prolonged by dull weather, a condition similar to over-fermentation is brought about resulting in discoloration of the testa in the form of little brown or black spots, a condition often present if the pods are over ripe before they are gathered, or if they are left in heaps some time before drying, despite suitable weather conditions for sun-drying.

On an average twenty labourers with 15 mules are regarded as sufficient for the maintenance of a plantation of 100 000 bearing trees. A labourer is paid about 1 *sucre* (= 2s 6d) per diem.

For valuation purposes the value of a plantation has been estimated by local banks at an average of about 80 *centavos* (2s) per tree in bearing.

The price of cocoa in 1920 was 42.50 *sucre*s per quintal in Guayaquil but there is obviously a wide margin for fluctuation which serves to indicate the profitable nature of the industry. The total costs to port of shipment are reported as about 8 *sucre*s per quintal (20s per 100 lb); the cocoa is shipped in bags containing 175 lb. net.

The "Asociación de Agricultores del Ecuador" which comprises all the producers and possibly also all the exporters of cocoa has for its main object the defence of the industry against the speculations of foreigners which tend unduly to lower the price of the local product, and is empowered to collect an export tax, in addition to the official Government export taxes.

This investigation was made with a view to the possibility of introducing the "Nacional" variety into the Gold Coast, Ceylon and other countries, and comparisons are made between the systems adopted on the Gold Coast and those employed in Ecuador.

M. L. Y.

425 - Factors other than those of Environment influencing the Alkaloid Content and the Yield of Latex from the Opium Poppy in India. — ANNETT, H. E. (Agricultural Chemist to the Government of Bengal), SEN H. D., and SINCH H. D., in *Memoirs of the Department of Agriculture in India*, vol. VI, No. 1, 60 pp., figs. 20, 1 diagr. Calcutta, Sept. 1921.

The authors have identified numerous subsidiary factors which influence the quantity of morphine contained in opium; their influence will be treated in a series of works beginning with the present. A summary is made of the works of different authors on the subject of the factors which influence the quantity of active principles produced by other plants and these results, taken in conjunction with those which they have themselves obtained, throw much light on the subject of the functions of alkaloids among plants.

Tables show the plot yield of opium at each successive incision and the content in morphine as well as the opium yield for 1000 capsules,

and from the experiments made in 1917-1919 to decide the question whether the quantity of morphine contained in the opium from the second and subsequent incisions can be modified by varying the intervals of time between the successive incisions, the authors draw the following conclusions:

The opium of the 1st incision is richer in morphine than that of the subsequent incisions; in practice, the method to adopt would be to collect the latex given off in the first few seconds from the surface of the capsule after the first incision. Possibly, if this first exudation of latex were removed immediately, a more copious flow of latex per capsule would be obtained in the 2nd yield made the following morning and in the succeeding yields, because the coagulation of the first deposit of latex around the surface of the incision must obstruct its free flow.

INFLUENCE OF VARIATIONS IN THE METHOD AND PERIOD OF THE INCISION ON THE COMPOSITION OF THE OPIUM. — The method of incision varies in the different opium-producing countries; the authors describe the methods adopted in India, France, Germany, Egypt, Asia Minor, Persia, China and Australia. They compared, by experiments made on a large scale, the Turkish mode of spiral incision, the transversal, vertical, etc. From tables showing the results thus obtained and a diagram illustrating the yield in opium according to the number of blades of the lancet used in making the incisions, etc., the authors draw the following conclusions:

1) The Turkish mode of spiral incision does not give a greater yield of opium than the Hindoo vertical incision, which is much simpler. The same holds good with regard to transversal incisions.

2) There is generally no advantage in making more than one vertical scarification at each incision.

The yield of latex is not increased in proportion to the number of scarifications; if 5 or 6 vertical scarifications are made, the yield is even less than with one only. Generally, 3 scarifications per incision yield much more than is obtained by one at the 1st incision; but in subsequent incisions, the yield obtained by the first method diminishes to such an extent that the final total yield is lower with a number of scarifications than with one only.

3) If at each incision instead of making the scarification along the whole length of the capsule, it be limited to $\frac{1}{3}$ or even less, the yield of latex is considerably less at the 1st incision. But the dry matter of this latex contains a higher percentage of morphine; further, in subsequent incisions, this percentage diminishes less rapidly.

4) An experiment for the purpose of testing the effect of the number of lancet blades used in making the incision shows that the 6-bladed lancet gives a total yield in opium per capsule higher than one with 2 or 4 blades, even to the extent of doubling it.

5) There is no difference either in the opium yield or morphine content according to whether an incision be made in the morning or in the afternoon.

6) The authors call attention to the fact that the size of the capsule and vigour of the plant have a great influence on results. It seems that a

large capsule on a vigorous plant may receive more than one scarification at each incision without suffering to any extent whereas a weaker capsule may give no latex at all if more than one scarification be made at each incision.

M. L. V.

429 - **Influence of Solar Radiation on the Culture of Belladonna and on the Formation of Alkaloids in the Leaves.** — GORIS, A., and DELMARD, A., in *Comptes rendus de l'Académie des Sciences*, Vol. 174, No. 3, pp. 183-190. Paris, January 17, 1922.

After cultivating the belladonna: 1) in the sun; 2) 6 weeks in the shade and then 6 weeks in the sun; 3) in the shade; and after gathering the leaves on the appearance of the first 2 or 3 flowers, the authors have observed that the leaves of group 1, at the 1st gathering, contained 0.65% (taking the weight of the dry leaves) of alkaloids, and on the 2nd gathering, 0.52%; the leaves of group 3 only contained on an average 0.39%. Further the adult plants grown in the sun yielded 3 crops from May to September, whereas the plants of the 2nd group required 3 months before yielding a crop. Finally, the plants grown in the sun yielded an average of 15 gm. of dry leaves each; those grown in the shade, 9 gm. only. Speaking generally the plants grown in the sun, as compared with those grown in the shade yielded 3 to 4 times as many leaves and 7 to 8 times the quantity of alkaloids.

F. D.

430 - **Interplanting of Trees on Coconut Estates. Observations made in Portuguese India.** — FURTADO, C. X., in *The Planters' Chronicle*, vol. XVI. No. 13, pp. 219-222. Colmbatore 1921.

The author as a result of observations made at Goa, has found it possible to catalogue the trees which may be allowed to grow on coconut estates with obviously advantageous results.

It should be noted at the outset that coconuts in Goa are usually grown on lateritic or sandy alluvial soils, which retain very little humus; the sub-soil is inclined to be compact and to contain a detrimental excess of moisture. Consequently a careful selection of trees for interplanting, employing deeper rooted varieties than coconut, thus rendering the sub-soil less compact, and varieties which from the point of view of foliage will serve as a useful source of humus, is of undoubted benefit to the plantation in general.

LIST OF TREES RECOMMENDED. — "Banyan" (*Ficus indica* Roxb.), "Indian coral" (*Erythrina indica* Lamk.), "hogplum" (*Spondias mangifera*), "horse radish tree" (*Moringa pterygosperma* Gaertn.), "belembi" (*Azadirachta Bilimbi* L.), "mango" (*Mangifera indica* L.), "pomelo" (*Citrus decumana*), guava (*Psidium Guyana* L.), "malay apple" (*Eugenia malaccensis* L.), "box" (*Ficus glomerata*). The last mentioned is chiefly grown along the borders of drains, tanks etc.

In addition to this list, the following, is also given of the trees considered undesirable:—

Portia tree (*Thespesia populnea* Correa), tamarind (*Tamarindus indica* Linn.), teak (*Tectonia grandis*), red silk cotton tree (*Bombax Mala-*

baricum D. C.), "cashew" (*Anacardium occidentale* L.). "poon" (*Sterculia foetida* L.), "jube" (*Zizyphus Jujuba* Lamk.), and *Mimusops Kanki* L. M. L. Y.

431 - The Cultivation and Commercial Possibilities of Safflower Seed (*Carthamus tinctorius* L.) in India. — HOWARD, A. (Imperial Economic Botanist) and REMINGTON G. S. (Consulting Chemist, Aynsme Technical Laboratories, Grange over Sands, Lancashire): in *Agricultural Research Institute, Pusa, Bulletin* No. 124, pp. 1-14 Calcutta 1921. — and *The Chamber of Commerce Journal*, Vol. XLIII, No. 418, p. 81 London, Feb. 3, 1922.

The safflower (*Carthamus tinctorius*) is widely cultivated in India both as an oil seed and to a much less extent for the reddish dye in the flowers (carthamin). Open sandy and rather dry soils best suit this crop, which is generally sown mixed with grain, barley or wheat.

Various species have been isolated and studied at Pusa, and the author gives a classification of 24 types with notes concerning their general habit, leaves, bracts and flowers, and the percentage oil content of each type respectively.

A number of seed samples have recently been analysed at Poona by MANN and KANITKAR with the following average result:— husk 50.8%; kernel 49.2%; oil in the whole seed (average of 55 samples) 31.6%; maximum 36.9%, minimum 25.4%. The various constants of safflower oil were determined and particular attention paid to its characters after heating under well defined conditions. Apparently it is only at 300° C in oxygen that the well known characteristic results of heating the oil become evident. By heating to 186° C in oxygen, a very marked reduction in the length of time required for drying was obtained.

Testing investigations were made in Great Britain under the direction of the author REMINGTON into the commercial possibilities of safflower. Reference has already been made to this work in the Scientific Reports of the Agricultural Research Institute, Pusa 1920-21 (1), but the author here gives full details of the various tests carried out.

The economic uses of this oil have already been summarised (1) and it is also stated that it can be utilised with success as a substitute for oil in paints and varnishes.

In India, the meal should be used to best advantage in the manufacture of soaps, or as a slow acting manure for agricultural purposes. An analysis of the meal was made with the following results: % moisture 7.50, oil 2.21, albuminoids 15.96, carbohydrates 35.48, crude fibre 32.88, mineral ash 5.97. As feeding material however the meal should be considered useless on account of the high crude fibre content.

Although the investigations so far undertaken have proved undoubtedly the high economic value of the safflower, further investigations are in progress in the Pusa laboratories as to the protein value of the seed, etc. M. L. Y.

(1) See R. March 1922, No. 227. (Ed.)

¹² - **The Cultivation of Capsicums in Algeria.** — GIBIER L., (Conseiller agricole à Orléansville) and FOURNIER F. (Chef de la Station expérimentale de Ferme-Blanche (Oran), in *Revue Agricole de l'Afrique du Nord*, Year 29. No. 131, pp. 76-78, figs. 2. No. 132, pp. 96-98. No. 133, pp. 109-110. Algiers, Feb. 1922.

During the last three years, distinct progress has been made in Algeria with regard to the production of capsicums, especially in the Perréaux region, which possesses a sandy loam particularly adaptable to their cultivation. The area covered from 1919-21 is given as 130 hectares.

The recent establishment of several factories, specially constructed for the manufacture of red pepper, pickles etc. has done much to emphasise the industrial value of capsicums and the authors state that should the drying processes and the methods of cultivation in general, be perfected, there is every possibility of obtaining a condiment of first-class quality which should rank with the best produced in Spain which is recognised as the leading country for red pepper.

The actual varieties cultivated are not clearly defined, but the following classification has been found possible.

The Dwarf Red Tomato var., almost spherical in shape; scarlet; pungent taste. This is the chief variety grown (80 ha). Three crops per year are obtained in June, end of September and in November or December; used for red pepper.

2) Improved Bull-nose or Sweet Mountain var., large fruits, blunt, with squared ends; furrowed; thick flesh, mild flavour. Used for pickles or eaten fresh.

3) Long Red Spanish pepper: flavour strong, cultivated in Orléansville.

4) Cayenne pepper, small; red; shape slightly curved; strong and burning flavour. Chiefly used by natives, but not often for commercial purposes.

The best results have been obtained on light soils, rich in humus, specially on the sandy loams in Perréaux. Ploughing takes place twice, in December and in early March, and directly after the second ploughing, ridges are made 40 to 70 cm. apart. Farmyard manure is applied at the rate of 10 000 to 25 000 kg. per hectare; the addition of leaf mould as in some cases been found advantageous.

Sowings are made in December or January, and the seedlings are ready for transplanting towards the end of March or in early April, and are planted about 30 cm. apart in some cases and more thickly in others (20 to 25 cm.). Of the two methods employed viz. 1) flooding the furrows previous to transplanting and 2) leaving the furrows without water until later, the first has proved the more satisfactory.

During the growing period, frequent waterings are given in the early stages and afterwards at intervals of 15 to 20 days up till the fruiting stage: from which time onwards, until cropped, only 5 to 10 days is considered necessary.

The cultural operations are limited to two or three hoeings.

The harvest season starts towards the end of June and continues

until the beginning of January, but the later ripening fruits are of inferior quality.

A description is given of the drying process employed for the capsicums intended for red pepper manufacture and also for pickles etc. In the first case, the waste product is estimated at 6 to 7 % of the total weight of dried capsicums. In the second case usually about 50 days are allowed before the preserves are taken out of the hermetically sealed recipients, which are then bottled for sale. The prices obtained in Algeria are subject to considerable fluctuations, but the following average for three years is given: dried capsicums, 300 to 400 frs. per quintal; fresh capsicums: 25 to 70 frs. per q.

As regards cost of production and net profit per hectare, an estimate is given for the Perrégaux district in 1921 (in francs): land rent 70; soil preparation 70; ridging 20; manuring (20 qx at 5 frs. per q.) 100; transport of manure etc. 50; collection of plants and transplanting 70; hoeing and weeding 300 (15 to 18 frs. per person per day); thinning out fruits, 30; irrigation, 60; manual labour for about 20 waterings, 150; cropping (collecting of 200. qx of capsicums at 2 fcs. per q.) 400; general costs 150. Total 1470 fcs.

The average yield per hectare is estimated at 200 qx. of fresh capsicums and the total value should be 5000 frs., taking the average sale price at 25 frs per q. The net profit should be therefore 3430 frs. per hectare.

In Orléansville, the net profit, however, is lower, not exceeding 800 frs per ha. and the industry appears to be gradually dying out in this district.

M. L. Y.

433 - Possibilities of the Mushroom Industry in India. — BOSE S. R. (Professor of Botany, Carmichael Medical College, Calcutta), in *Agricultural Journal of India*, vol XVI, No. 6, pp. 613-647. Calcutta, Nov. 1921.

Up to the present time there has been no regular cultivation of edible mushrooms in India, but as a result of the author's investigation as to the nutritive value of the indigenous wild varieties it appears highly probable that mushroom growing will become a special industry in India.

A chemical analysis has been made of the most common edible varieties found in Bengal and it is to be noted that some of them are superior to the English mushrooms etc. as is shown in the following Table.

Species	Protein	Carbo-hydrates	Fats (Ether extracts)	Ash	Moisture
					analysed in dry condition
<i>Volvariella terastius</i>	2.28	trace	0.18	—	—
<i>Collybia (Leptota) albuminosa</i> . .	12.8	14.8	trace	—	—
<i>Agaricus campestris</i>	2.74	1.60	0.37	0.15	95.2%
Puff balls (<i>Gasteromycetes</i> from Bankusa)	2.20	1.35	0.56	0.16	94.8%
English edible.	0.18	0.46	0.03	—	—
American Edible.	2.25	4.95	0.20	—	91.3%

The tissue culture method in sterilised dung medium has been adopted to obtain artificial cultures of these local Agarics. The object is to make active spawn and thus facilitate production on a large scale and consequent economic development.

The results of an enquiry instituted by the Royal Botanic Gardens, Kew, prove that there is a ready market for edible mushrooms in Burma, Punjab, Kashmir and Afghanistan, provided that a regular supply is forthcoming.

M. L. V.

34 - **The Avocados of Guatemala.** — LEITCH, MARIE and LEITCH, MARGUERITE, in *Revista de Agricultura de Puerto Rico*, Vol. VII, No. 4, pp. 5-35, figs. 19, San Juan, October, 1921.

The Guatemala varieties of Avocados (*Persea gratissima*) differ from those of Porto Rico origin in various ways: 1) The former have a thick rind and adherent stone, which enables them to be exported, while the native varieties have a thin skin and the stone moves about in the cavity, so that the interior of the fruit is injured during transport.

2) Many of the Guatemala varieties grow as high as mango-trees, and are therefore able to bear more fruit than the native varieties.

3) Some Guatemala varieties fruit at different seasons, spring, summer, autumn or winter; thus, ripe avocados can be obtained throughout the year.

4) The Guatemala varieties are much richer in fatty substances than the native kinds. According to the variety, the former contain 16 to 30 % of fatty substances (1) and the latter only 10 %.

5) The Central American varieties fruit much earlier; the "Lyon" variety is mentioned as bearing fruit in the nursery, and is said to produce a crop from the age of 4 years. The "Puebla" variety begins to bear when 2 years of age, like "Fuerta" which, when it is 4 years old, produces 100-300 fruits per tree while the "Spinks" variety fruits 3 years after being grafted.

6) A large number of Guatemala varieties bear fruit at high altitudes in their native country at from 900 to 1200 and even 1500 metres above sea-level. The Porto-Rico varieties, on the other hand, are sterile at high altitudes. Thus, the deforested hills of Porto Rico could be covered with woods of "aguacates", and a profitable crop might be obtained.

7) The Guatemala varieties are usually resistant to strong winds.

8) Some of these varieties produce good wood and dense shade, which makes them useful in the Guatemala coffee plantations. Two crops can thus be obtained on the same ground. These trees can bear a great number of fruits without damage to their branches.

9) The fruit of several of these varieties can be left hanging on the tree for some months.

Of the 30 varieties of Guatemala avocados, that have been imported

(1) See R. Sept. 1920, No. 828. (Ed.)

into Porto Rico (Plantación de Mangos y Aguacates de Bayamón), 5: specially recommended for growing for the market; these are: *Fuente Spinks*, *Dickinson*, *Sharpless* and *Puebla*. Their characters are as follows: *Fuente*: fruits from January to August. Weight of fruit 325 to 400 g. contains 30.72 % of fatty substances.

Spinks: fruits from April to August; weight of fruit 450 to 560 gm. contains 21.75 % of fatty substances.

Dickinson: fruits from June to October: weight of fruit 330 gm. contains 20.36 % of fatty substances.

Sharpless: fruits from October to February; weight of fruit 560 gm. contains 24.23 % of fatty substances.

Puebla: fruits from December to February; weight of fruit 225 to 280 gm. contains 26.68 % of fatty substances.

Among the other varieties may be mentioned: *Lyon*, *Dickey*, *Perfecto*, *Altixco*, *Mérito*, *Grande*, *Taft* and *Blakeman*.

The same variety cannot be obtained from seed and hence grafting is necessary. As *Persea gratissima* grows into a large tree, it should be planted at intervals of 9 or even 12 metres, if the soil is very fertile. The same precautions must be taken as in planting a fruit-tree in the orchard: the hole should be 60 cm. deep and 1 m. wide; the soil must be mixed with well decomposed dung and compost, and then filled up to form a mound 30 cm. in height, and 1.50 m. in diameter, etc.. When once planted, the young tree must be protected from the wind and sun by means of canvas, or palm leaves; this shelter is no longer necessary after it has taken root and a new bud has developed. It must, however, be protected against the wind for at least a year.

It is advisable to place dry grass round the tree and this should be changed every 3 months. A prop is indispensable, for the tree must grow perfectly straight. It should be watered in dry weather.

The analysis of the edible pulp of the "aguacate" gives the following results (1): Water 72.8 %; protein 2.2 %; fatty substances 17.3 %; carbohydrates 3.4 %; crude fibre 1.9 %; ash 1.4 %. The avocado is thus a fruit of considerable food value and is eaten in large quantities by the working classes of Guatemala.

The cultivation of *Persea gratissima* in Porto Rico is likely to develop considerably, not only on account of the actual value of the fruit, but because of the possibility of exporting it to the United States. Porto Rico is the only tropical possession of the United States which is near enough to satisfy the demand for avocados, as both the Philippines and Hawaii are too far off.

P. C.

435 — Propagation of Date Palms by Seed. — TRABUT, in *Comptes rendus de l'Académie d'Agriculture de France*, Vol. VII, No. 33, p. 718-721. Paris, October 1921.

The date-palm is generally propagated by cuttings taken in the spring. These cuttings, however, do not always strike, and are in any case, very

(1) See R. Sept. 1920, No. 828. (Ed.)

ble to be infested by parasites, especially by the scale-insect, *Phoenicoccus marlatti*, which attacks the cuttings before they are planted out.

On the other hand, date-palms are easily propagated from seed, but in this case, the characters of the variety, especially when it is a good one, are not reproduced in their entirety. Date palms are dioecious, and when fertilised artificially, the offspring is directly influenced by the parents. The natives, however, never take into consideration the origin of the pollen. Some years past, male palms with all the characters of the "deglet nour" variety (which is much in request for export), have been observed at the American Experiment Stations.

The female date-palms fertilised with the pollen of these valuable male trees have produced offspring similar, except for some slight variations, to their parents. The author has received some "deglet nour" pollen from America and used it at Biskra for fertilising bunches of the same variety. The dates thus obtained are very fine and have a smaller size than the fruit of bunches fertilised with the pollen used in the district.

Thus date-palms bearing choice fruit can now be obtained from seed, which is very economical, for a date-palm raised from seed bears fruit sooner than one grown from a cutting, and it also makes a more vigorous tree.

P. C.

36 - Fruit Trees that can be Interplanted on Coconut Estates. — See No. 430 of this Review.

37 - Viticultural Questions in Italy. — I. SANNINO, F. A., La Luglienga, in *Rivista di Ampelografia*, Year II, No. 9, pp. 129-131. Alba-Livorno, September 1, 1921. — II. PIROVANO, A., Profumo sintetico di Moscato, *Ibidem*, pp. 131-135. — III. SANNINO, F. A., Il vitigno portoghese bleu in Italia e all'estero, *Ibidem*, No. 10, pp. 145-146, October 1, 1921. — IV. PIROVANO, A., Port'innesti italiani, *Ibidem*, No. 12, pp. 177-180, December 1921. — V. SANNINO, F. A., Uve da tavola, *Ibidem*, Year III, No. 1, pp. 3-11, January 31, 1922. — VI. ZERIOLI, F., Le principali uve da tavola che l'Italia esporta, in *L'Italia vinicola ed agraria*, Year XIII, No. 10, pp. 148-150. Casalmongera, March 5, 1922. — VII. *Idem*, La nostra esportazione di uva da tavola in Svizzera, *Ibidem*, No. 9, p. 132, February 26, 1922.

I. — "Luglienga" is a white grape peculiar to Piedmont where it is cultivated even in the valleys of the Alps.

It is also known in Lombardy and even better in Venezia, where it is grown under the name of "San Giacomo".

The vine is distinguished by its early ripening and has to be trained on trellises.

Luglienga must be pruned for long canes, but if the stock is prolific, bunches of fruit are seen on the shoots of the spurs and also on the shoots of the vertical portion of the fruit stock, shewing that the lower buds are fertile. The author mentions the case of a vine-grower who trained "Luglienga" at Milazzo (Sicily) on horizontal cordons, and made an angular incision in the fruit buds of the spurs; he gathers the grapes at the beginning of July, before the Algerian and Tunisian grapes are ripe.

Manuring with potassic salts (to increase the sugar content and diminish the acidity), was more successful than annular incisions in securing early ripening.

The cultivation of this table grape, which for one month has no rival on the market, is most profitable, and the author advises its extension.

Average weight of ripe bunch 192 gm.; must composition: sugar 17.92 %; total acidity 5.70 per 1000; cream of tartar 4.28 per 1000.

II. — PIROVANO states that he detected the Muscat aroma in 2 hybrids I. P. 6 and I. P. 7 fertilised with the pollen of "Ferdinand de Lesseps" which had been obtained in England by PEARSON from a cross between a white Chasselas and Isabelle or strawberry grape. Isabelle has a fine taste which is much less noticeable in Ferdinand de Lesseps (in which it is transformed into a pleasant flavour) and still more slightly in these hybrids which have a muscat aroma. Special mention should be made of the "hybrid Pirovano 7" (I. P. 7), the result of the cross "Madeleine royale" × "Ferdinand de Lesseps". It is a very early, strong prolific vine, though not without defects. It becomes weakened by grafting on an American stock, or a European × American hybrid, and like all the varieties of *V. Labrusca* and their hybrids, is subject to tillosis. Long-lived and productive vines can however be obtained by a careful choice of the soil, stock and fertiliser.

III. — Prof. SANNINO calls attention to the good qualities of the blue Portuguese vine, which is characterised by the early ripening of the fruit and the fact that its grapes are suitable both for the vat and the table.

PULLIAT has recommended it for cold districts where it can replace early varieties, such as Pinot and Gamay, being quite as early and more productive. The author advises its use for supplying vat grapes for cold districts in place of Dolcetto (1), for it is more vigorous, and perhaps hardier, while its grapes do not drop so easily.

The author gives the ampelographical characters of this vine which produces purplish-black grapes. Even the lower shoots bear fruit, so that it can be pruned short. As the blue Portuguese vine is very strong-growing and productive, the plants must not be placed too close together. As it is subject to anthracnose, it should be allowed to reach a certain height in districts where the spring is wet. The best results are obtained by growing this vine on warm slopes with a good exposure; at Alba, it does well on hills with a very clayey soil. The vintage of September 1921 produced at Alba a must with the following composition: sugar 19.70 %, total acidity expressed as tartaric acid 5.9 per 1000; cream of tartar 4.78 per 1000. It is desirable to add some bisulphite of potassium during fermentation, as by this means a wine of good colour, with red effervescence and greater acidity is obtained.

This vine is much grown in the neighbourhood of Vienna, and at Mous and Schumberg, where it produces an ordinary table wine of good quality. It is grown in Hungary under the name of "Oporto". The wine

(1) See R. 1920, No. 660. (Ed.)

ade from the produce of vineyards on the plain has an earthy flavour, it when grown upon the slopes of Transylvania these grapes yield a fine wine with a clean taste. It is alcoholic, full bodied, soft and well coloured, lacking in acidity and tannin. Under the name of "Plant de Porto" this vine has been largely grown in Champagne in the vicinity of Epernay, here it produces a highly-coloured, full bodied wine. It yields fairly rich table grapes which are ready for eating in August, though they are not completely ripe, for the pulp is not very acid, and the flavour not pleasant, if not very sweet.

IV. — PIROVANO mentions two stocks that he has obtained: 1-37, "Golia" (1), and 2-59, or "Gagliardo"; they are derived respectively from the crosses 15 612 × *Rupestris* du Lot and 15 612 × *Riparia* 420 A. 5 612 was obtained by CASTEL and is a product of the cross Carignan × *Riparia*. Both have an excellent grafting affinity and the diameter attained by the stem is equal to that of European vines. They are also resistant to drought but their chief characteristic is extraordinarily vigorous growth.

Golia does best on acid, heavy, poor soils with a lime content not exceeding 40 %. Its luxuriant growth makes this vine unsuitable for such soils, unless it can be allowed to develop freely; it could be used to cover arbour, as it would cover them very quickly.

Gagliardo can bear the same amount of lime and is suited to damp soils where *Riparia* × *Rupestris* would grow well. The latter runs it very close as regards vigour, and has a closer affinity to European vines.

V. — The author calls special attention to the desirability of developing the cultivation of table-grapes, both as a remedy for over-production, and in order to keep up the price of wine (to insure a fair profit) by decreasing its production.

Basing his advice on his personal observations and on those of Prof. RACAH (*L'Italia Agricola*, 1921, No. 12, p. 375), he recommends the following vines: Golden Chasselas, which grows admirably in Tuscany — *Glianga* — *Précoce de Courtiller* (with Muscat flavour) — *Madeleine royale* — *Panse précoce* — *Madeleine angevine* — *Précoce de Magre*, all earlier than Chasselas — *Colombana*, or *S. Colombana* for districts near the Tyrrhenian Sea (over 30-40 kg. from the coast the grapes have their beautiful golden colour) — *Salamanna* or *Alexandrian* Muscat which corresponds to the Muscat of Calabria, and the *Zibibbo* of Sicily — *Tarratto Cerletti* Muscat for Sicily and Apulia.

VI. — The following information has been taken from a report presented by Filippo ZERIOLI, a great exporter of Italian grapes, to the "Commissione vinicola" at the Ministry of Agriculture.

MILAZZO. — *Chasselas* (bunch regular, skin thin, berries large; gathered middle of July; yield in 1921, 2000 quintals; vineyard reconstituted on American stocks; countries of consumption: Switzerland,

¹⁾ See *R. Nov.* 1921, No. 1127 (*Ed.*)

Germany — *Varesana* (bunch regular, berries large, fleshy, hard skin resistant) vintage, early in August.

BARI. — *Chasselas* vintage early in August; yield in 1921, 100 quintals, zone infected with phylloxera, vineyard in course of reconstruction; country of consumption: Germany, especially Saxony. Before the War another grape, the black "Tarantino" vat grape, was also sent to Saxony as a table fruit; during the War exportation was suspended and has not been resumed on account of the high cost of production.

LECCE. — *Varesana*, *Somarello*, *uva Rosa* (bunch regular, large berries fleshy, hard skin, resistant); gathered early in September; yield in 1917 40 000 quintals, in 1921, 15 000 quintals. Same observations as in the case of Bari.

NAPLES. — *Catalanesca* (bunch irregular, grapes large, yellow, fleshy skin hard); vintage late; places of consumption: Naples, and in some years to a small extent, Milan. An attempt has been made to send these grapes abroad, but the consignments had to be discontinued as the fruit does not bear transport.

TERRACINA. — *Muscat* (yellow, scented grape, bunch irregular skin hard, berry medium size; vintage from middle of August to early in September, production in 1913, 35 000 quintals, in 1921, 45 000 quintals vines immune to phylloxera. In 1897, an attempt was made to export these grapes, but they were found to travel badly, and at the same time their flavour is not appreciated in Germany.

TERAMO AND CHIETI. — *Trebbiana* (bunch irregular, berry average colour golden yellow): gathered the first 10 days of September; yield in 1913, 45 000 quintals, in 1921, 45 000 quintals. — *Mondonico* (large compact bunch); vintage end of September; yield in 1913, 8 000 quintals in 1921, 8 000 quintals: sent to Switzerland, Germany and some Italian towns, especially Milan. Before the War, "Montepulciano" (a red vat grape), was also sent but the consignments have ceased owing to the high cost of production.

SAN SEVERO. — *Trebbiana* (compact bunch, small yellow grapes) vintage middle of September: markets: Switzerland and Germany. It has not been exported since 1913, owing to its high price.

BOLOGNA. — *Chasselas* (bunch compact, skin thin, grapes rather large); vintage in middle of August; yield in 1913, 30 000 quintals; in 1921 10 000 quintals; grows in phylloxera-infected zone, vineyard under reconstruction: sent to Switzerland and Germany. Before the War "Negretto" (a red vat grape), was also exported as a table grape. — "Regida" (large yellow berries); gathered early in September.

PISA. — "Bordò," or *Golden Chasselas* (type Bolonais *Chasselas*) vintage early in September; yield in 1913, 7000 quintals, in 1921, 7000 quintals; vineyards already invaded by phylloxera and completely reconstituted; sent to Switzerland and Germany. — *Colombana* (regular loose bunch, thin skin, average-sized coloured berry); vintage early in September; yield in 1913, 15 000 quintals; in 1921, 15 000 quintals markets: Switzerland, Germany, Genoa and Milan.

PLAISANCE. — *Bianchetta* (bunch regular, skin thin, berry average); vintage in middle of August; yield in 1913, 5000 quintals, in 1921, 5000 quintals; markets, Switzerland, Milan, Genoa. — *Verdea* (bunch regular, skin thin, berry average-sized, resistant); vintage middle of September; yield in 1913, 32 000 quintals; in 1921, 10 quintals; phylloxera-infested one; vineyard being reconstituted; markets: Switzerland, Germany, Genoa and Milan. These grapes are kept in a room on screens and sent to the markets of Genoa and Milan until April. — *Bazzegano*, or *Besgano* red table-grape, bunch regular, berry large, fleshy, skin hard; vintage in the middle of September; yield in 1913, 4 000 quintals, in 1921, 4 000 quintals; markets: Switzerland, Germany, Genoa and Milan.

ALBA (Piedmont). — *Angela* (large berries, thin skin); vintage late; yield in 1921, 5 000 quintals; markets: Genoa, Turin and Milan. This grape is kept on screens all the winter.

VII. — The annual exports of table-grapes from Italy to Switzerland from 1914 to 1921 were (in quintals) — 23 566 — 14 210 — 19 633 — 13 572 — 83 447 — 22 769 — 29 491 — 61 261; while from France, from 1919 to 1921, they were; 5 797 — 31 993 — 15 382. In 1913, Italy sent 14 000 quintals of grapes to Switzerland, and 387 000 quintals to Germany.

F. D.

138 — Substituting Shield Grafting for Double Cleft Grafting in Vines. — FERRICELLI, E. (Consorzio viticolo Trani), in *Giornale viticolo italiano*, Year 48, No. 8, pp. 72-74. Casale Monferrato, February 19, 1922.

Shield-grafting, for some years declared by the best known authorities on vine-growing to be the type of grafting least suited for the re-establishment of vineyards, is now coming increasingly into favour, on account of the good results obtained by many Sicilian vine-growers. The author especially recommends it in its whistle and ring forms, but he does not approve of shield budding or bud-grafting as this form is not sufficiently firm.

The English or double cleft graft unites firmly and the scion grows well for a certain number of years; it does not, however, guarantee long life for the stock owing to the frequent hypertrophy of the tissues at the point of union and the difference in the diameter of the scion and stock which is thereby induced.

Ring grafting affects only the zone of tissues which readily makes second growth (phloem parenchyma and cambium), whereas in double cleft grafting, the incision nearly always severs the supporting tissues from the wood-vessels which cannot be directly united.

The "quatre-lames" generally used is not suitable for making a whistle-graft; and a "tenailles Ottavi" is to be preferred for the purpose. In this implement there are two short-cutting, semi-circular blades fixed at the right distance, which clasp, by means of a strong spring, the branch to be grafted. Thus the instrument cannot swerve from the plane of the cut and if a simple, rotary movement of rotation is given to the pincers, 2 perfectly circular cuts are made on the branch and when these are

completed by the longitudinal cut, the ring of the cortex with its bud can be easily detached.

F. D.

439 - **Forestry in Norway and the Official Efforts for its Advancement.** — BJÄRNE O. T. (Director of Agriculture, Department of Agriculture), in *A Short Review of Agriculture and Forestry in Norway and of Official Efforts for their Advancement* (issued by the Department of Agriculture), 64 pp., figs. 9. Christiania, 1921.

Forest lands cover a considerable portion of the area of Norway namely over 7 million hectares. The principal forest trees are: Spruce fir (*Picea excelsa*), Scots pine (*Pinus sylvestris*), birch lowland birch *Betula verrucosa* in the low-lying districts and mountain birch *Betula odorata* in the highland districts; *B. nana* covers large tracts of land in the high mountains. In addition to these three types of tree there are also to be found the following: ash (*Fraxinus excelsior*), oak (*Quercus petunculata* or *sessiliflora*), beech (*Fagus sylvatica*), lime (*Tilia parvifolia*), alder (*Alnus glutinosa* and *incana*), aspen (*Populus tremula*) and several other species.

Considering the northerly situation of the country, the forests extend to a great height above sea-level; in the Eastland, conifers grow up to an altitude of 900 metres and deciduous trees (birch) to 1100 to 1200 m.

The conditions of working are facilitated to a considerable extent by the long winter with its settled weather and good transport conditions, and by the many water-courses which are suitable for carrying timber. The working of the forests therefore, in spite of the mountainous character of the country, may be described as easy. Owing to the great extent of the forest area, a comparatively large number of workers can be employed on the land during the whole year, for the work in the woods is chiefly done in winter, while the summer is the busiest time for agriculture.

The output of the forests far exceeds the country's own requirements and there is thus a large export of timber and other forest products, especially wood-pulp and paper. In the last few years, the annual export of timber has risen to about 1 300 000 cub.m; 700 000 tons of wood-pulp; and some 200 000 tons of paper and cardboard. There are in Norway 119 wood-pulp mills, some of them very large, and a great number of saw-mills and planing mills.

Most of the forests (about 84 %), are in private ownership, 48 % belonging to farmers, while 36 % are worked independently of agriculture. About 16 % belong to the State, and other official or semi-official institutions.

The work of the Government for the advancement of forestry and agriculture comprises; the official measures put into operation by the State Administration for agriculture and forestry; the work that is carried on by agricultural and forestry associations; forestry instruction.

The Department of Agriculture has 2 divisions, each of which has its executive Chief: 1) The Agricultural and Concession Division; 2) the Forestry and Veterinary Division. The latter has the following branches: Forestry, Reindeer and Freshwater Fisheries, Land Re-distribution Veterinary.

All public administration relating to forests and forestry comes within the purview of the Forestry Office. The Director of Forestry is in charge and stands in the same position towards the Department as the Director of Agriculture. In addition to the administration of the woods and forests in general the Director of Forestry is responsible for the business management of the forests belonging to the State which comprise a comparatively large area, as will be seen below. The Office is divided into a technical and a legal section, as in the case of the Agriculture and Production Offices. Under the Forestry and Veterinary Division are 3 Forestry Inspectors of whom, however, 2 only have offices in the Department.

The Agricultural Societies are grouped in an Institution known as "Det norske Landbruksraad" (The Norwegian Agricultural Council), in which "Det norske Skogselkap" (The Norwegian Forest Society), and the "Norske Skogeierforbund" (Norwegian Forest-Owners' League), each have 2 representatives.

In addition to the 3 Inspectors of Woods and Forests mentioned above, 40 forest-managers, 20 assistants and about 500 wood-rangers are under the Control of the Director of Woods and Forests, all of whom are entirely in the service of the State. The Director also has the control of the following Bureaux that are carried on entirely for State purposes: The State Forestry Valuation Office: this office regulates the boundaries, and makes surveys, valuations etc. of the public forests and of the forests offered for sale to public Authorities. The permanent Staff consists of 2 forest valuers with 4 assistants.

The National Valuation Office for Forests, has been established for the purpose of furnishing, by means of direct measurements and investigations, statistics regarding the Norwegian forests. Its work consists in the first place in supplying answers to the following questions: 1) the area of forest and its distribution according to the different species and qualities of timber; 2) the existing supply of growing timber; 3) the amount of the current yearly increase, etc.

The work in the field proceeds by counties in the form of lineal valuation.

The permanent Staff of the National Forestry Valuation Office consists of 2 forest valuers together with the Office Staff. The other officials for the field-work are engaged every season.

According to the general scheme, the valuation is to be completed in the course of 5 years, for 9 of the largest forest-growing counties in the country. During the same period, the census of the forestry industry is to be carried out throughout Norway in order to ascertain the annual production of all the forests in the country and the consumption for household purposes. In this connection, returns are collected from all the forest properties in Norway giving the output for 3 consecutive years.

The State founded in 1917 an Experimental Station for Forestry at Haslum near Christiania. The Staff at present consists of 2 experimentalists and 2 clerks.

There is also an Experimental Station for Forestry affiliated to the

Bergen Museum, the principal contributor to its support being the Norwegian Forestry Society.

The State supports in various ways the work required for the preservation and renewal of the forests. Large nurseries of plants for sale have been established in various parts of the country. The State has also erected seed drying-rooms in several districts.

Since 1872 the State has been planting the treeless wastes in Vestland and has regularly carried on cultivation work in its own forests. It has planted altogether on the moors of Vestland 3700 hectares of forest, which has, generally speaking, thriven very well. The State also makes grants for private plantation and for plantation carried out by local authorities. The latter can also obtain for the purchase of ground for planting, loans free of interest and of repayment of principal for 30 years.

In regions that are poor in woods, and in districts where it is to be feared that the forests, owing to their northerly situation or great altitude may die out if neglected, the State aims, if possible, at acquiring the forests to secure their preservation.

The Norwegian Forestry Society ("Det norske Skogsselskap"), founded in 1898, is one of the Forestry Associations with a semi-official character; it depends partly upon private funds and partly upon grants from the State. Its objects are to diffuse information regarding the afforesting of treeless tracts and the advancement of Norwegian forestry in general. Dependent upon this Society are the local forestry societies (1 in each county). The County Forestry Societies have in their service about 50 fully qualified officials who give gratuitously to forest owners advice on all matters concerning forestry, in the same manner as an Agricultural Official gives advice on agricultural questions.

Through the forestry societies the State gives grants for the planting of forests both to private owners and local authorities.

The Norwegian Forest-Owners' Union is an amalgamation of the local associations of forest owners which are to be found in most of the forest districts throughout the country. It was founded in 1913, with the object of protecting the common interests of forest-owners, especially as regards the sale, transport, measurement and floating of timber. The Union also gives assistance in all the more important legal questions and other matters of special importance for forestry.

Pursuant to the law of July 1, 1887 concerning the utilisation of the water-courses, those persons on whose account timber floating on a river is conducted are entitled, when the majority of them are agreed, to decide that the floating shall proceed in common and under joint management, as well as to lay down the rules under which it is to be carried out. In order that decisions regarding the adoption of a joint scheme of floatage, or alterations in the adopted rules may be valid, the majority must represent at least $\frac{1}{3}$ of the quantity of timber floated on the particular water-course during the preceding year. The rules are subject to the approbation of the King in Council. These combinations are called Associations for Joint Floatage and have been established along most of the great water-

courses of the country, and by improving the river channels a great impetus has been given to the work. Expenses are covered by a charge upon the timber transported.

Until recently, the purchaser himself prescribed the rules for the dimensions of the timber he bought and was responsible for the measurements taken; hence in many cases, the seller was more or less at the mercy of the buyer. In order to secure a more equitable arrangement there have been established of late years, along the main water-ways, special institutions with permanent and sometimes attested measurers, who receive timber on behalf of the buyer. These institutions are called *Assosiasjoner* or *Measuring Timber* and their establishment is quite voluntary. They have a Council of Management to which one half of the members are elected by the buyers and one half by the sellers, the buyers and sellers each bearing half the cost.

The Norwegian Mutual Forest-Fire Insurance Company was founded in 1912 by the Norwegian forest-owners. The Company insures the forests for a premium of 1.25 per 1000 of the sum assured in cases where forest-fire regulations have been introduced. Where such regulations have not been established the premium is 1.75 per 1000. After a period of insurance for 4 years, a reduction of 20 % is made in the premium. After a further 4 years, a reduction of 0.4 per 1000 is allowed in the form of a bonus. Most of the insured persons have thus an effective premium of 60 øre per 1000 *kroner* of the insurance benefit. Only the forest ground and the young wood are included in the insurance, but not timber trees. In 1920 about 65 % of the forest area of coniferous trees was insured in the Company to a total value of 259 124 000 *kroner*.

Other associations concerned with forestry may be mentioned such as: the Norwegian Timber Export Association ("Norsk Trelasteksportforening"), the Norwegian Pit-props Exporters' Association ("Norsk Propseksportørers Landforening"), the Norwegian Cellulose Association ("Norsk Celluloseforening"), the Norwegian Wood-pulp Association ("Den norske Tremasse forening") the Norwegian Paper makers' Association (De norske Papirfabrikanter Forening), and Norway's Timber Union ("Norges Trelastforbund").

The forest-owners have their own bank, the Forest-Owners' Bank ("Skogeierbanken") and a Cooperative Bank has recently been founded, The Norwegian Credit Association for Agriculture and Forestry ("Norges Kredittforening for Land og Skogbruk").

As regards Forestry Legislation, the law of August 8, 1908 for the preservation of protective woods and against the destruction of forests, with the supplementary law of June 7, 1916, may first be mentioned.

By virtue of these laws, rules have been established by Royal Order in Council for the hewing of timber in the various rural districts; these rules generally contain amongst other provisions, a clause prohibiting the cutting down of trees under a fixed minimum dimension, except where such under-sized trees are hindered in their growth, stunted, damaged or the like. The State allows one half of the expenses incurred in se-

curing the proper observation of the law. In districts where the local authorities have not of their own initiative passed bye-laws, the general regulations fixed by the supplementary law of June 7, 1916, hold good.

The Act of July 14, 1893 regarding restrictions on the use of fire in woods and fields etc., with the amending Act of 1921, lays down certain restrictions upon the use of fire in forests and enjoins upon the district Authorities the enactment of so-called "forest-fire regulations" According to these regulations, every able-bodied man in a district may be called upon to assist gratuitously in extinguishing forest-fires.

Amongst other laws may be mentioned, the Act of May 20, 1899 regarding the hunting and snaring of game; the Act of July 20, 1918 regarding the housing of men and horses engaged in forest work and timber floating. The so-called "Mountain Law" of March 20, 1920, gives to the local Authorities in the highlands the power of regulating for the parishes their fishing, hunting and pasturing rights on the commonlands belonging to the State, including also the common forest-lands; while the Act of August 20, 1915 forbids the separation from the farm-holdings of the forest and mountain tracts necessary for working the farm.

By a number of laws enacted from 1906 onwards various restrictions have been imposed upon the free right of acquiring water-falls, mines, forest, land and mountain properties, lime-pits, peat-bogs and certain other national assets.

As regards Forestry Instruction, the High School of Agriculture for Norway includes a Forestry Section and owns an estate and some forest-land on which experiments are carried out. Instruction in Forestry is also given at the Lower School of Agriculture, and in 5 State and 3 County Forestry Schools, where the course lasts for 1 year, and at 2 County Forestry Schools, attached to agricultural schools, with a 1 1/2 year's course.

For the financial year, July 1, 1921 to June 30, 1922, the Forestry Service budget was as follows: Expenditure 10 821 000 kroner; income 7 823 292 kroner. In these figures are included the expenditure and income for all forests administered by the Director of Forestry, as well as contributions to the State and County Schools of Forestry and to the Norwegian Forestry Society.

G. A. B.

440 - Effect of Orientation upon the Success of the Transplantation of Forest Trees. - MARTIN ZÉDÉ, in *Comptes rendus de l'Académie des Sciences*, Vol. CLXXIV, No. 4, pp. 61-63. Paris, January 3, 1922.

When making plantations of different species of trees (firs, spruces, larches and birches), in the island of Anticosti, the author found that if the orientation of the trees was not changed, the number that did not take root was greatly diminished (from 50 % to 6-8 %). This phenomenon was perhaps more noticeable owing to the inclement climate of Anticosti (Canada).

In practice, before moving trees, it is necessary to notice their orientation, in order that when transplanted, they may be arranged in such a manner that the parts which originally faced north, may again have the same direction.

G. A. B.

441 - **Paraguay Timber Industry.** — *The Board of Trade Journal*, Vol. CVII, No. 1313, p. 104, London, Jan. 26, 1922.

The growing importance of the timber industry of Paraguay may best be gauged by the following figures showing the exports of timber during the last five years:—

Year	Logs		Sawn Timber	Fence Posts	Spacers	Quebracho Logs
	Rough	Trimmed				
	Tons	Pieces	Cub. M.	Pieces	Pieces	Pieces
1916	8 608	33 000	1 315	52 513	544 221	1 006
1917	38 995	39 000	1 777	47 586	1 026 066	1 605
1918	47 710	47 228	4 533	24 980	1 234 717	522
1919	51 821	41 171	3 848	52 841	1 135 724	1 668
1920	47 222	63 314	5 852	60 281	3 138 426	269

The export of quebracho logs has greatly declined since the war, and the production is now almost totally absorbed by the tannin factories. No quebracho grows in Eastern Paraguay and the industry is confined to the Chaco Territory. The average quantity of extracts of quebracho exported during the last seven years is 24 027 tons a year (maximum 32 976 in 1919 and minimum 12 710 in 1914). G. A. B.

442 - **The Timber of India and Burma** (1). — HOWARD, A. L., in *Journal of the Royal Society of Arts*, Vol. LXX, No. 3613, pp. 238-248, figs. 6. London, Feb. 17, 1922.

The author made an extended tour in 1921 through some of the chief timber-producing areas of India, Burma and the Andaman Islands, with the object of gauging their possibilities for trade development.

From nearly 2500 different species to be found in these forest areas only a small proportion are of economic interest, and scientific knowledge concerning them has up till now been limited and very few of the trees have been known to timber buyers elsewhere. The somewhat vague term "teak and jungle-woods" has in many cases proved detrimental to the trade, seeing that in these so-called "jungle-woods", logs of much value are to be found superior even to the finest mahogany, or satin wood, and boxwood known.

The author has selected a few of the most outstanding specimens, and describes their commercial value (2).

1) Laurel wood, *Calophyllum Inophyllum* Linn — a dark reddish-brown wood with a handsome wavy grain. Its durability compared with walnut, for which it may prove be an excellent substitute, may be regarded as beyond question.

2) Gurjun (*Dipterocarpus turbinatus* Gaert.) and other *Dipterocarpus* spp. Found in Burma, Chittagong and the Andaman Islands. This

(1) See *R.* Jan. 1919, No. 1. (Ed.)

(2) Supplemented by notes on the given specimens taken from *Timbers of the World* by A. I. HOWARD, Macmillan Co. 1920).

timber is available in very long lengths and large sizes, free from any defect and according to the results of the breaking tests, it has proved to be stronger than oak (*Quercus pedunculata* Ehrh. and *Q. sessiflora* Sm.). It is apparently not possible to break the wood right through; two pieces continue to remain jointed together by what appears to be a tough outer skin which forms a kind of hinge. For joinery and carpentry work etc. the wood should first be thoroughly seasoned and whenever possible sawn on the quarter, which prevents shrinking. It makes a beautiful flooring and has also been utilised advantageously for panelling etc.

3) Indian Silver greywood. This varies in shade, but possesses a permanent coloration, in which respect it differs from the so-called "greywood" or stained sycamore which up to the present has been so much in use. A careful selection of the different colour varieties gives a very harmonious effect for parquet flooring, furniture etc., and the commercial value is highly estimated.

4) Pyinkado (*Xylia dolabriformis* Benth) — the iron wood of Burma, hard, heavy, strong and durable. The thick oily substance in the pores has a tendency to exude on to the surface after the wood has been worked which may be conducive to durability, but has certain drawbacks when the wood is used for flooring.

The wood is chiefly used for railway sleepers, but it has also proved very valuable for building purposes. Though it is so hard, it can be sawn and worked without much difficulty when comparatively fresh.

5) Padauk (*Pterocarpus* spp.). — The Andaman padauk (*Pt. dalbergioides* Foxb.) (syn. "vermillion wood" and "East Indian mahogany") — very strong and durable, hard and firm, does not split, shrink or expand with any climatic change; the wood possesses a brilliant lustre which distinctly adds to its commercial value when utilised for making furniture etc.

The padauk of Burma (*Pt. macrocarpus* Kurz.) is of a duller colour but possesses strength, toughness and elasticity to a marked degree.

Both types of padauk have been approved by the Admiralty as a substitute for "sabicu" (*Lysiloma Sabicu* Benth) in the construction of battleships.

6) Indian Boxwood (*Canthium didymum* Roxb.). — A shipment of this boxwood recently examined, contained two different kinds of wood one type which apparently does not split in the log or when cut up, or after manufacture, and the other which is liable to split under all these conditions. The great value of the first type is evident.

It should be noted that neither the Indian boxwood nor the West Indian sp. *Tecoma pentaphylla* Juss come under the genus *Buxus*.

7) Haldu (*Adina cordifolia* Hook) — in India, Burma and Ceylon — noted for the remarkable quality of the grain, smooth texture, durability and attractive colour, is worked very easily and does not split; it is also readily adaptable for chair making, carving, brush work etc. — and for shuttles and bobbins.

8) Koko (= East Indian Walnut) (*Albizzia Lebbeck* Gamble) — re

markable for its handsome colouring and good shape; its durability is excellent.

9) Pynima (*Lagerstroemia Flos-Reginae* Retz) — a magnificent timber hitherto almost entirely overlooked, but probably a more valuable wood in its general qualities than any timber, for example, in the whole of North America. In India it is not as valuable as teak, as it is only partially resistant to attacks of white ant., in Europe however the author considers it ranks almost as high as teak. Its great reliability, coupled with excellent qualities of texture and grain, places it on a very high level for decorative wood work.

10) White Bombwe (*Terminalia procera* Roxb) — a very strong wood with firm, hard and close texture. Although there appears to be scarcely any actual demand in India, it should not be assumed that it cannot be utilised advantageously elsewhere. It should be borne in mind that the chief factor which determines the use of wood in India is its resistance to white ants, dry rot etc. — points which are not of importance in other countries.

11) White Mahogany ("Prima Vera"). Source unknown (native of Central America) — a wood possessing a smooth, silky surface and very easily worked; light weight but strong enough for fittings, fixtures in cabinet making, joinery and ship-building.

Attention is drawn also to the coral wood ("bois de corail") of the Andaman Islands, sissoo (*Dalbergia Sissoo*) which has been successfully used for fine cabinet work, and thitka (*Pentace burmanica*) which resembles Cuba mahogany.

M. L. Y.

443 - Determination of the Value and Uses of the Various Timber and other Forest Products in British North-Borneo (1). — SMITH, MIDDLETON, in *The Engineer*, Vol. CXXXII, No. 3444, pp. 710-711. London Dec. 30, 1921.

There seems to be a continuous demand for Borneo Timbers and it was decided to make a series of tests to discover the properties and values of various samples hitherto insufficiently known outside Borneo, in order to satisfy the demand more adequately. There can be located within this belt, a number of blocks of 50 000 acres on which the stand of marketable timber will average 2 000 cub. ft. or more per acre. Estimates based on 169 342 acres on the East Coast show the average stand to be 2613 cub. ft. per acre, the two species occupying the greater part of the stand being the "Seriali" or Borneo cedar (*Hopea* sp.) which is the most abundant timber of North Borneo, and the "kruen" or "apitong" (*Dipterocarpus grandiflorus* Blanco) a timber suitable for constructional work, and suggested as useful for gun-stocks.

From the results obtained from the tests it was found that all the samples were more resistant to bending than crushing. The following were classed as hard woods and their average coefficient of bending strength was determined as follows:

(1) See *R.* April 1919, No. 476. (Ed.)

"Selangan batu" 8.06; billian (Borneo iron wood) (1) 7.29; "mirabow" (2) 6.77.

The following were classed as soft woods:—"greeting" 4.92; camphor wood (3) 4.93; oba sulu 4.92; orat mata 4.57; kruen 4.45 (4); kacha 4.24 and red serayah (5) 3.54.

A number of preliminary tests were made on samples of local woods in order to determine the most satisfactory method of loading and the best method of measuring deflections.

As a result of the tests for uniformity, the selangan batti was found the most uniform and after this the "oba sulu" and red "serayah". The crushing strength of each was within 10 % the mean value.

The results of the bending and compression tests on samples submitted by the China Borneo Company are given in tabular form.

[LIVE STOCK AND BREEDING]

- 441 - **Studies on Foot and Mouth Disease in France** (2). — I. SCHEIN, Dualité possible de la fièvre aphteuse, in *Comptes rendus de l'Académie des Sciences*, Vol. 174, No. 3, pp. 204-206. Paris, January 16, 1922. — II. VALLÉE H. and CARRÉ A., Sur l'immunité anti-aphteuse. *Ibidem*, pp. 207-208.

I. — As a working hypothesis, SCHEIN suggests that the name of foot-and-mouth disease has been given to two quite different maladies. Both are self-immunising, but neither are reciprocally immunising. True foot-and-mouth disease (aphthic fever), would appear to be contagious to man and pigs, or to one or other only, whereas "aphthoid fever" (the other disease), cannot be contracted by human beings or swine, or any other animal that is not subject to aphthic fever.

II. — VALLÉE and CARRÉ give reasons to explain the instability of anti-aphthic immunisation and also raise the question of the plurality of aphthic viruses. F. D.

- 445 - ***Solenopotes capillatus*, a Sucking Louse in Cattle, hitherto unknown in the United States.** — BISHOP F. C. (Entomologist, Investigations of Insects affecting the Health of Animals, Bureau of Entomology, U. S. Department of Agriculture), in *Journal of Agricultural Research*, Vol. [XXI, No. 11, pp. 797-801, figs. 6, Washington, September 1921.

Solenopotes capillatus n. g. and n. sp. was described in 1904 by ENDERLEIN; this parasite was found on cattle in Leipzig. The author has discovered that the species has a wide distribution in the United States. He describes its life-cycle and states that, unless the measures necessary for its control are taken, it will become a serious cattle pest. F. D.

(1) *Ensiferum* Zwageri Tand B., (2) *Intsia Bakeri* Prain and *Alsezia palembanica*, (3) *Dryobalanops aromatica* Gaert; (4) *Dipterocarpus grandiflorus* Blanc; (5) *Hopon* sp. at *Shorea leprosula* Mq. (See *Timbers of the World* by A. L. HOWARD p. 425, Macmillan Co., London).

(2) See R. Mar. 1922, No. 278. (Ed.)

146 - Diseases and Parasites of Sheep in Syria. — See No. 457 of this Review.

147 - Stomoxes as Carriers of Dromedary Trypanosomiasis. — SERGENT, R. and DOXAÏEN, A., in *Comptes rendus de l'Académie des Sciences*, Vol. 174, No. 8, pp. 581-583. Paris, February 20, 1922.

The authors, as a result of observations and experimental researches, have come to the conclusion that dromedary trypanosomiasis is naturally transmitted in two ways: 1) in the open country, in the wheat fields by *adflies*, for the larvae of these insects swarm in the damp sand of the alley bottoms; 2) in inhabited places (caravansaries), by stomoxes, for the straw litter in the stables harbours many of these pests. (The authors have found stomoxes in all the regions of North Africa, the coast, high-plateaux and the Sahara).

The trypanosomes do not develop within the insects, but are merely mechanically transported by them acting as carriers conveying the micro-organisms lancetwise on the exterior of their proboscis.

For the spread of the infection it is necessary that the insects should sting an animal suffering from trypanosomiasis in such a manner that he puncture bleeds, and then immediately sting a healthy individual. As trypanosomiasis is a disease of long duration in the dromedary, this animal acts as a reservoir of virus.

F. D.

148 - Experimental Researches on the Effects of Castration. — LEBNATI, L. (Istituto di Patologia comparata della R. Scuola Superiore di Medicina Veterinaria di Milano), in *La Clinica veterinaria*, vol. XLIV, No. 21-22, pp. 635-647. bibliography of 18 works, Milan, November 15 and 30, 1921; Vol. XLV, No. 1, pp. 14-30, bibliography of 48 works, January 1922.

I. — LEUCOCYTIC PHAGOCYTOSIS IN CASTRATED ANIMALS. — The author gives a brief sketch of some of the most important researches made on this subject, before proceeding to a detailed account of his own experiments (on adult dogs) the results of which lead him to conclude that castration causes a decrease in the phagocytic index of the leucocytes. This effect is the same whether both or only one testicle is removed; in the former case, however, it is less marked and tends to disappear after a certain time, whereas in the second it persists without any change for 80 days after the operation.

The endoperitoneal inoculation of testicle extract into animals from which both testicles have been removed at once causes a rise in the value of the phagocytic index, but this does not last long and 24 hours later it falls to its previous level.

II. — HAEMATOLOGICAL OBSERVATIONS ON CASTRATED ANIMALS. — This article gives a rapid review of the many works dealing with the effects produced on metabolism, the tissues, the functional correlations of the genital and other glands, the active protective mechanism against disease (phagocytosis, serological reactions etc.), and also describes the author's own observations as to the red and white corpuscles, both from the quantitative standpoint (absolute and relative estimate of the number of these bodies), and from the qualitative (morphology and structure of the corp-

uscles). The animals used in the experiments were dogs. The result obtained lead to the following conclusions:

1) Castration has no appreciable effect, either quantitative or qualitative, upon the red blood corpuscles, nor upon the total number of the white corpuscles. This applies equally to monolateral and to bilateral castration.

2) The castration of adult animals produces on the other hand very noticeable and durable changes in the relative quantity and ratio, of both kinds of corpuscles, and causes:

a) a considerable decrease in the lymphocytes; b) a certain diminution in the number of acidophilous, polynuclear leucocytes; c) an increase in the large, mononuclear leucocytes; d) a certain increase in the basophilous, polynuclear leucocytes; e) a very noticeable increase in the neutrophilous, polynuclear leucocytes.

3) The effect of castration upon the relative number of leucocyte is more evident in the case of bilateral than of monolateral castration. The results, which manifest themselves very quickly, have a certain tendency to become permanent.

F. D.

449 - **The Possibility of Castrating Animals by the Use of Serums.** — GIULIANI, R. (R. Scuola Superiore di Agricoltura, Portici), in *Giornale di Agricoltura della Domenica* Vol. XXXI, No. 39, p. 306. Palsance, September 25, 1921.

The author has studied the possibility of substituting "biological" for surgical castration effected by the application of the principle forming the basis of cytolytic serums. The laboratory experiments hitherto carried out have given encouraging results. These experiments were directed to the preparation of a rabbit orcholytic serum. A he-goat was used to supply the serum; periodic injections of the solution of nucleoprotein, from the testicle of the rabbit being made in constantly increasing doses. The serum thus obtained was injected into rabbits; 3 to 4 cm. were injected each time at intervals of 8 to 5 days. 15 days after the first treatment, the testicles were already perceptibly atrophied, and the seminiferous ducts although still recognisable, contained a kind of granular detritus. By prolonging the action of the serum for 30-40 days, a progressive atrophy of the testicle glands was produced; these were to a large extent empty, and consisted of albuginea, interstitial connective tissue and a little much modified parenchymatous matter, in which the seminiferous ducts could with difficulty be distinguished.

F. D.

450 - **The Rejuvenescence of Animals; Experiments on Old Fowls and Doe-Rabbits.** — CHARON, A. G., OZENÉ, G., and YONENO, G., in *Journal d'Agriculture pratique*, vol. 31 Part. II, No. 48, pp. 454-457, figs. 4. Paris, December 3, 1921.

CHARON in his paper recalls: 1) the discovery of BROWN-SÉQUARD (1869), that all the glands, whether provided with secreting canals or not supply to the blood certain useful principles, and that when the glands become less active in consequence of accident, disease or old age, the absence of these products makes itself at once felt; 2) his experiments in rejuvenating old persons (increasing their muscular force, cerebral exc-

tion and general vigour) by means of the injection of the testicular fluid of rabbits, or guinea-pigs; 3) the opotherapeutic measures based on the knowledge thus acquired — 4) the experiments of WORONOFF (Directeur de la Station expérimentale du Collège de France), on the rejuvenescence of animals by grafting pieces of testicle taken from still younger animals. Stress is also laid on the value of the application of these methods to farm-stock, if they were easy of execution, and the author publishes a communication sent to him for insertion in the *Journal d'Agriculture pratique* by Yasusi OINONÉ (Director of the Oinoné Institute of Agricultural and Biological Research at Ogawa, Japan), and YONENO (Aviculturist of the Oinoné Institute).

These authors mention the rejuvenescence methods devised by STEINACH (*Archiv für Entwicklungsmechanik*, vol. XLVI, 1920), and by SASAKI (of the Faculty of Medicine in the University at Kyusiu). The methods suggested by STEINACH consists of the removal or ligature of the 25a deferentia, and that of SASAKI in administering, through the mouth an extract of the thyroid gland. They afterwards describe their own experiments, carried out according to the SASAKI method on old fowls and doe-rabbits. White Leghorn fowls of 6 years of age were given fasting, once daily at 6 in the morning, 0.03 gm. of dry extract of thyroid gland. The results were entirely satisfactory, as is shown by Table I. One of the birds which had only laid 25 eggs in 1915-1919, laid 129 in 1921-1922. The hens thus treated also became youthful in appearance; their skin grew fine and soft, their combs delicate and bright red and their movements were full of vigour.

TABLE I. — *Rejuvenescence experiments with fowls of six years of age, March 31, 1920.*

Length of treatment	Number of eggs laid	
	From Sept. 1 1918 to Aug. 31 1919	From Sept. 25 1920 to Sept. 24 1921
	without treatment	With treatment
5 days	22	68
5 days	28	50
0 days	24	99
0 days	29	103
0 days	25	129
0 days	26	105

Excellent results were also obtained with the doe-rabbits (Belgian breed); the data are given in Table II. Their appetite increased, they regained a youthful appearance, their fur became thicker, and they showed symptoms of heat and all but one (No. 2), were fertilised.

CHARON draws attention to the fact that it is quite conceivable that the thyroid extract, by exciting the reproductive functions, would stimu-

TABLE II. — *Experiments in the rejuvenescence
7-year-old Doe-Rabbits, in 1919.*

No.	Duration of treatment	No. of young in litter produced after treatment	Appearance of animal after treatment
1. . . .	10 days	3	Slightly younger looking. Little vivacity
2. . . .	10 days	0	Rejuvenated; very lively
3. . . .	25 days	7	Much rejuvenated; very lively
4. . . .	25 days	5	Much rejuvenated; very lively

late egg production in fowls that are fairly good layers. The treatment can be carried out by giving in the morning, thyroid gland, or iodo-thyrine, mixed in suitable doses with a light paste. F. D.

451 - **Horse-Breeding in Czecho-Slovakia.** — *Bulletin of the Ministry of Agriculture of the Republic of Czecho-Slovakia, Year II, No. 3, pp. 23-24. Prague, 1921.*

The breeding of horses for agricultural purposes is organised by the Ministry of Agriculture. The Military Authorities also have Stud Stations for breeding Army horses. The horse-breeding establishments are (except in rare cases), military institutions, and under the management of Stud Officers, or of army veterinaries. The Staff is composed of soldiers and civilians, except at Kladruby, where the Stud Station (the former Stud Station of the Emperor of Austria), is entirely managed by civilians.

In Bohemia, the horse-breeding Stations are at Domazlice, Nemošice and Písek. In these establishments stallions for use in the country only are bred, but at Nové Dvory, there is a State Horse Rearing Station where the young stallions bought from horse-breeding farmers are reared to supply the State Stud Station. At Kladruby, there is a similar establishment which is better suited to the purpose, as mares are also available whose foals have been weaned. In Moravia, the State Stud Stations are at Hodonin and Zlejšcin — in Silesia, at Opava — in Slovakia, at Nitra, and Prešov — and in Sub-Carpathian Russia, at Turg-Kemety. Another Stud Station has recently been established in Slovakia.

In Bohemia and Moravia spirited, more robust horses of the oriental type or pure-bred English horses are bred for improving the blood. In the Czech countries farmers prefer the Ardennes or Noric breeds; in Slovakia, the oriental or the Noric, horse is the favourite. In Pre-War times, the interests of the army ranked before the farmers' with the result that the requirements of agriculture have not been satisfied.

In Sub-Carpathian Russia in the mountainous districts small robust "hucul" horses of a Polish breed are the best suited, and most in demand, for agricultural purposes.

In the Republic of Czecho-Slovakia, horse-breeding is organised in such a manner that the countries are divided into two districts. In the first, light mettlesome horses only may be reared, and in the second, only the heavier breeds. The zones are determined after some years have elapsed, according to the number of mares belonging respectively to light or heavy breeds to be found, as reported by the Commission under the control of the Ministry of Agriculture.

The Chambers of Agriculture, in conjunction with the Ministry of Agriculture of the former Monarchy, have supervised horse-breeding and collaborated with the Stud Stations for the disposal of stallions that are unsuitable for sires, in making Service Stations in the different districts, supplying stallions for private breeders, etc.

The service season for the mares lasts from February 1 to June 30. The Service fee is 200 crowns. In Bohemia, there are 130, in Moravia 80, in Silesia 30, and in Slovakia 120 special Stations with from 1 to 10 stallions at the disposal of horse-breeders, the State paying the rent. In addition there are private Stations which are only kept open in the same place for 4 years for the 2 types of breed.

The number of State stallions is estimated at 600 in Bohemia (half being of each type), 450 (in the same proportion), in Moravia and Silesia, 420 in Slovakia (where almost all are of the lighter type), and at 20 (light-type) in Sub-Carpathian Russia, that is to say, the State possesses altogether 1510 stallions.

There are only about 240 stallions belonging to private individuals. These animals must have a Government Service Licence according to the decree of 1874 in Bohemia and to the law of the country (1905), in Moravia. A new law is being framed to establish other horse-breeding districts.

The most famous private Stud Stations are those of Baltazzi (Najedla), Sailern (or Lukov, in Moravia where Belgian and English breeds are reared), Schwarzenberg (or Hluboká; English pure bloodstock), Baur Pohled), Kinsky (Lysá n. L.), etc.

In Bohemia and Moravia, there are Unions and Cooperative Societies for breeding heavy blood animals or horses of the Noric breed. The Czechs prefer the Belgian and the Noric breeds. The Czech cooperative societies are very prosperous and are able to buy and import foreign horses without any grant from the State. The Unions of the native breeders are at Sv. Dvory, Breznice, Pardubice, Benesov (light type), Caslav, Pouchov, Prepychy, Belohrad, Budejovice, Netolice (heavy breeds) etc. In Moravia, the Horse Breeders' Union includes 38 Czech Societies (20 for the breeding of light and 9 for the breeding of heavy horses), and 7 German Societies; 4000 mares are registered on the Stud-Books.

The chief horse-markets are at Budejovice, Benesov, Netolice, Chrumum, Usti n. L. Horse-races are held at Prague, Bratislava, Pardubice and Karlovy Vary.

In pre-war Austria in 1866 the direction of horse-rearing passed from the control of the Ministry of War to the control of the Ministry of

of the experiment, the average length of the gestation period was 335 days and the difference in the case of the two sexes was scarcely one day.

The author has drawn up Tables relating to the winter-feeding (from October 9 to May 8), of 66 just weaned foals, 53 foals of over one year age and 46 two-year-olds. The average consumption was in the first group, 551 kg. of grain + 724 kg. of hay, or 4.8 kg. of grain + 6.3 kg. of hay per kg. of increased live-weight; in the second, 684 kg. of grain + 1150 kg. of hay, or 8.7 kg. of grain + 14.6 kg. of hay; in the third, 862 kg. of grain + 1267 kg. of hay, or 25.6 kg. of grain + 37.7 kg. of hay.

The rations given were: for sucking foals, a little grain 3 times a day, beginning with 100 gm. and gradually increasing up to 450 gm; for weaned foals, 680 to 910 gm. of grain 3 times a day, and in addition, 1 kg. to 1.8 kg. of hay in the morning and 1.8 kg. to 2.3 kg. in the evening; for foals over one year old 1.4 kg. of grain in the morning 0.9 kg. at midday, and the same amount in the evening, as well as 3.6 kg. to 4 kg. of hay morning and evening; for foals above 2 years of age, 1.4 kg. of grain 3 times a day and from 4 kg. to 4.5 kg. of hay morning and evening.

If it is assumed that a sucking foal consumes 82 kg. of grain, the total amount consumed by a foal from birth until 3 years of age is about 2 quintals of grain and 31 quintals of hay.

The average weight of 66 foals at birth was a little over 52 kg., the 33 colts weighing 52.7 kg. and the 33 fillies 52.2 kg. The average weight (geometrical average) of 67 foals on May of the year following their birth was 345 kg.; the average increase in the mean weight was 291 kg., or 53 % in 377 days from birth.

The average weight of 53 foals on May 9 of the year when they completed their second year, was 494 kg. showing an increase of 153 kg. over their weight in the previous year, or 44 % (409 gm. per head and per day). The decreased rapidity of growth was still more marked in the following year; on May 9 of their third year, the foals weighed on an average 576 kg. or 76 kg. more than in the previous year i. e., 15 %. If the weight at birth is subtracted, it is found that the foals had gained 524 kg. in 3 years, or 31 kg. having been put on during the first 377 days. This shows the importance of insuring the rapid growth of the animals from the beginning. The above-mentioned data are a further confirmation of the statement that growth during the early stages of a foal's life is not only more rapid, but obtained with the consumption of less food.

The cost of rearing a foal up to the age of 3 years is estimated as follows.

The author gives a large number of general rules for the feeding and management of brood-mares and foals.

On a farm devoted to horse-breeding, it pays best, as a rule, to purchase food in more or less large quantities. On a general farm, all the food consumed by the horses should be grown on the premises.

On farms where general crops are cultivated, and the horses have much hard work to do at the harvest seasons and when important operations are in progress, but are little used the rest of the year, it pays well

to employ mares, since the foals they produce make up for the days lost during foaling etc.

	dollars
Service fee	15.0
Days of work lost by the mare during service and foaling *, 10 at 1 dollar each	10.0
Insurance and risks { Brood-mare 200 dollars 3 % risk Foal of less than 1 year 40 dollars 20 % risk Foal of more than 1 year 70 dollars 1.5 % risk Foal of over 2 year's 120 dollars 1.5 % risk }	16.8
Veterinary service and medicines	2.0
Keep and stabling	20.0
Food (grain and hay).	108.6
Pasture	15.0
Total	181.4
Credit for work done from the age of 2 1/2 years	29.1
Net cost of foal at the age of 3 years	152.3

* The mares continue working to within a few days of foaling as this has been found beneficial both for dam and off-spring.

Given that the net cost of rearing a three-year-old foal may be reckoned, as appears from the above, at about 160 dollars, and that the animal will fetch 225 dollars, a profit of 50 dollars viz., 30 % on the capital employed will be obtained. F. D.

453 - Essays on the Depreciation in the Selling Value of Injured Horses. Permanent Lameness. — NICOLAS E., in *Recueil de Médecine vétérinaire*, Vol. XCVIII, No. 1, pp. 71-80, Paris, January 30, 1922.

The damages to be paid by third parties who are responsible for accidents come under two heads: *compensation for temporary inability to work*, if lameness disappears; *compensation for actual depreciation* (which must be paid in addition to the first), if the horse is permanently lamed: The author considers the question of assessing this latter liability for which there is at present no guide.

The consequences of lameness are of two kinds: 1) economic; 2) physical.
1) *Economic standpoint*. — The lamed animal has lost its usual capacity for work owing to diminished speed, or increased fatigue.

The kilogram output per second (D') is the result of the product of the animal in kilogrammes (E) and the speed per second in metres (V). — $D' = E \times V$. As there are no existing data whether of an empirical or experimental character for measuring the decrease in V due to lameness, the decrease in the output cannot be directly determined.

The author avoids the difficulty by first calculating the pecuniary loss involved in a determined incapacity for work and obtains the following formula :

$$\text{Pt. r.} = g \times n \times (14 - a) \times \frac{i}{100}$$

where $Pl. r.$ = loss of return;

$g.$ = daily return from animal after subtracting expenses of keep.

n = number of work-days per annum.

a = age of animal at the time of the accident ($14 - a$ can however never fall below unity if a is 14, or higher);

i = incapacity for work expressed in centimes.

Two cases may occur: a) incapacity for work involving a loss of output greater than the maximum possible depreciation of the horse (it is evident that it is the maximum depreciation that must be paid in compensation); b) a loss of return lower than the maximum depreciation, in which case the actual loss alone must be made good.

The maximum depreciation (Dp. m.) that a horse can undergo is given by the formula (1):

$$Dp. m. = Vba - P \times p \times c$$

where Vb is, other things being equal, the value of the horse before the accident according to the age ready-reckoner;

b = the weight of the horse;

p = the price per kg. of meat of the horse as it stands;

c = a coefficient that is 1, if the animal is only fit for the butcher, and above 1 if the horse has still some work in it before it is slaughtered. According to some statistics relating

to rejected army horses, the author has taken c as $\frac{10}{8}$. This coefficient is,

however, liable to variation according to the season, place, etc., which require to be determined. (2)

In order to calculate the loss of output due to a given incapacity for work, it is necessary in the first place to determine what amount of incapacity for work is produced by different degrees of lameness. Three such degrees may be considered: a) severe lameness, or when the animal has to go on three legs, causing an incapacity of 50 to 100 %; b) slight lameness, scarcely perceptible, causing an incapacity of 1 to 5 %; c) unqualified lameness, which is the most common; this the author divides into 2 categories: acute lameness causing an incapacity for work ranging from 20 % to 50 %, nearly always entailing the maximum depreciation; slight lameness, 5 to 20, which generally causes partial depreciation.

2) *Physical standpoint.* — The importance of the horse's lameness depends upon the use made of the animal. In saddle or trotting horses, it entails the maximum depreciation.

Owing to the serious economic results of lameness, the expert should in practice consider carefully in the case of a recent accident likely to

(1) See R. Feb. 1922, No. 189. (Ed.)

(2) See: NICOLAS: Points de repère pour l'estimation de la valeur des chevaux de réformation de l'Armée. (Points to be taken into account in estimating rejected Army horses), in *Recueil de Médecine vétérinaire* No. 17, p. 299, Sept. 15, 1921 — The sale price of a rejected horse does not depend upon its age. It is about $\frac{3}{8}$ of the purchase price at the same date. The chief factor regulating the sale price is the weight of the animal; $\frac{1}{10}$ of the total value of the horse is represented by its worth to the butcher, and $\frac{2}{10}$ by its value as a work-animal. It is easy to calculate the former as a function of the price per kg. of the meat, of the weight and return (on an average 50 %), and all that is required, in order to ascertain the market value of the animal, is to multiply the butcher's estimate by $\frac{10}{8}$. (Ed.)

cause permanent incapacity for work, whether it is worth while to undertake any treatment. To decide this point, a comparative estimate must be made of the value of the horse on the one hand, and the probable cost and possible depreciation on the other. This can be done by means of the following equation :

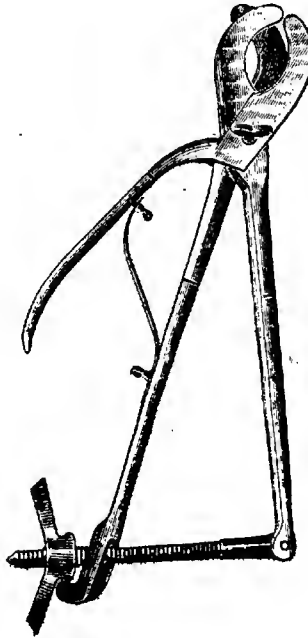
$$\frac{\text{Maximum depreciation}}{\text{damage} + \text{loss of output}} = x$$

If the proportion is below or equal to unity it is economically useless to treat the horse, and its slaughter should be recommended. In any case, treatment is expensive and may prove unsuccessful ; there is considerable risk that the outlay involved in 2 or 3 months' medical care, feeding, and the hire of a substitute will be thrown away upon a depreciated horse.

F. D.

454 - Lesbouyries' Pincers for Castrating Horses. — LESBOUYRIES, in *Revue de Médecine vétérinaire*, Vol. XCVIII, No. 2, pp. 53-44. fig. 1. Paris, January 30, 1922.

Castration by means of crushing the seminal cord is usually practised with an emasculator, or with REINER's pincers, which have the advantage



LESBOUYRIES' Pincers.

age of affording great haemostatic security. The author, however, found that the grip of the crusher was not regular or always sufficient to insure haemostasis, and that after a certain number of operations, the knife deviated from the arm of the crusher, so that only an inadequate and unsatisfactory section was made. In order to remedy these defects, certain modifications were made in the pincers. The jaws are tightened by a rapidly-moving spring, instead of by a toothed-bar; the cutting-blade is made independent, by being mounted on a special screw; other minor alterations have also been made so that the instrument can be easily taken to pieces. The accompanying figure shows the instrument in its new form. F. D.

455 - **New Methods of Judging Cattle** (1). — I. KOPPE, Das ostfriesische und provinziälsächsische Körverfahren; II. CORNELIUS, Das oldenburgische Körverfahren; III. Das jeveitländer Körverfahren; in *Deutsche landwirtschaftliche Tierzucht*, Year XXV, No. 17, pp. 170-171. Hanover, April 1921. — IV. GOWEN, J. W., Studies on Conformation in Relation to Milk-Producing Capacity in Cattle, in *Journal of Dairy Science*, Vol. IV, No. 5, pp. 359-374, Baltimore, September, 1921. — V. MARCQ J. (Institut agronomique de Gembloux) and MARY M., Des modes d'appréciation du bétail dans les concours et du type idéal bovin à rechercher en Belgique, in *Annales de Médecine vétérinaire*, Year XLVI, Nos. 8-9, pp. 337-364. Ixelles-Brussels, August-September 1921. — VI. COLOMBE M., Appréciation des qualités beurrières et laitières chez les vaches, in *Journal d'Agriculture pratique*, Year LXXXV, No. 44, pp. 377-379, and No. 45, pp. 391-393. Paris, November 1921.

X. — **CATTLE JUDGING AT SHOWS IN EAST FRISIA AND THE PROVINCE OF SAXONY (PRUSSIA).** — Cattle entered at Shows in East Frisia are judged according to LYDTIN's method. The judge scores for milk conformation, head and horns, coat, colour, conformation, capacity, general appearance: 5 points mean excellent, 2 good, 1 mediocre, 0 poor that is to say, rejected. For milk conformation and general appearance the points are doubled. The perfect animal thus receives 24 points to which are added points for measurements (18 in the case of a perfect animal), or 42 points altogether.

Three points at the maximum are given for the following first 3 measurements taken together, and 3 for each of the others:

height: a) at withers; b) at centre of back; c) at point of withers; d) at insertion of tail; e) length and width; f) of chest; g) of pelvis; h) of haunch; i) depth of chest:

b) should not be less than a;

c) should not be greater than $a + 8$ cm;

d) should not exceed $a + 6$ cm;

e) in cattle 3 years of age should at least be $a + \frac{1}{10}a$; in the case

of older animals, it ought to be $a + \frac{3}{20}a$;

f) at least $\frac{1}{3}$ of a.

g) at least $\frac{1}{2}a$.

(1) See R. April 1921, No. 411. (Ed.)

Should the width of the chest and pelvis and the length and depth of chest exceed by 5 cm. the required measure, the animal is classed as good, if they exceed them by 10 cm. the animal is classed as excellent.

This method, in which the number of points depends upon the opinion of the judge and upon measurements, has been in vogue until recently, but the number of entries at the shows has now increased to such an extent as to make it impossible to carry out the measurements. For this reason, the "Gesellschaft für Züchtungskunde" (German Stock-Breeding Society), has taken the initiative in introducing a new scale of points to be adopted throughout North Germany.

In the new method of scoring used by the "Verband für die Zucht des Schwarzbunten Tieflandrindes in der Prov. Sachsen" (Union for Breeding Black Pied Netherland Cattle in the province of Saxony), a maximum of 100 points is credited to the ideal animal, each part being estimated by points 1 to 5, as follows: 5 = excellent; 4 = good; 3 = fair; 2 = mediocre; 1 = poor, rejected. The scale of points is as follows.

1) General appearance.	5 × 4 points
2) Head, horns and neck.	5 × 2 "
3) Shoulders, chest.	5 × 1 "
4) Back, flanks, loin, paunch.	5 × 2 "
5) Pelvis, croup, hip, insertion of tail.	5 × 3 "
6) Thurl'	5 × 1 "
7) Limbs, gait.	5 × 1 "
8) Colour, skin, and coat.	5 × 1 "
9) Udders and milk ducts in the case of cows; genital organs in bulls.	5 × 2 "
10) Development, vigour.	5 × 2 "
11) Pedigree.	5 × 1 "
Total	100 points

KOPPE proposes putting general appearance at the bottom of the scale so as to summarise the preceding points.

II. — METHOD OF CATTLE-JUDGING ADOPTED IN OLDENBURG. — Since 1909, only the offspring of registered animals may be entered on the Oldenburg Herd-book and these are subjected to a very strict examination, especially in the case of bulls. There is a supplementary register ("Hilfsbuch") for good cows born of unregistered parents; the female (but not the male) offspring of the cows entered on this register, if sired by a registered bull, may be entered after examination on the Herd-book. Registered bulls only are allowed by law to serve cows not belonging to the owners. The accompanying form is used in judging bulls (Table I).

This form is a modification of the one proposed by MÜLLER for the cattle of Jeverland.

TABLE I. — *Form used in Oldenburg in judging bulls.*

Name
 Date of calving
 Breeder
 Owner
 Date of examination Place where examination took place

	Points	Remarks
1) Back line and position of tail		
2) Length		
3) Depth of chest, abdomen		
4) Shoulders and width of flanks		
5) Hips and pelvis		
6) Thurls and hocks		
7) Width of chest, position of shoulders and neck		
8) Neck, head and horns		
9) Skin and coat		
0) Colour		
1) Strength, shape and position of limbs		
2) Gait		
3) Vigour		
4) Pedigree		
5) Udders and signs of capacity for milk-production		
6) General appearance		

Points 5 = excellent, 4 = good; 3 = fair; 2 = mediocre; 1 = poor; 0 = very poor.

Maximum of points = 90; minimum for acceptance, 54. For evidence of capacity for milk production, and for general appearance, double points are given.

III. — METHOD OF CATTLE JUDGING ADOPTED IN JEVERLAND. —

In the territory of the "Jeverländische Herdbuchverein" (Union of Pedigree Cattle Breeders in Jeverland), bulls entered have been judged since 1861 in accordance with a law passed that year. Until 1901, the animals were judged only by the eye without any measurements.

Dating from 1893, many investigations have been carried out by means of measurements made with LYDIN'S apparatus. The data obtained served to determine the normal development of the animals at different ages, and were taken by MÜLLER as the basis of his cattle-judging method which has been adopted in Jeverland since 1901. According to this method, 15 notes each of 3 points can be given for each animal viz.: 0: bad; 1 fair; 2 good; 3 excellent. The third note (general appearance) may have double marks, so that the points for the perfect animal will be 48. For admission to the herd book, an animal must obtain at least 28 points. If 2 out of the 3 judges see at a glance that an animal cannot be admitted, no measurements are taken and it is withdrawn. The points based on measurements are 5 in number: back line, length, width of pelvis at hip, width of chest, depth of chest. In each case the minimum dimensions admissible are fixed for the different ages of the cattle.

TABLE II. — *Form Adopted*
by the "*Deutsche Landwirtschaftsgesellschaft*".

	Maximum Number of points	Points credited by each judge	Average number of points	Remarks
	2	3	4	5
I. <i>Breed value:</i>				
1) Breed, colour, pedigree	10			
2) Vigour	10			
3) Health, strength	10			
II. <i>Body:</i>				
1) Head and neck	5			
2) Trunk	10			
3) Limbs, gait	5			
4) Skin and coat	5			
III. <i>Productive value</i> *	30			
1) Signs of capacity for milk production . . .	—			
2) Signs of capacity for beef production . . .	—			
3) Signs of capacity for work	—			
IV. <i>General appearance</i>	—			
<i>Total</i> . . .	100			

* In scoring for milk, beef and work in the case of different breeds, the market value must be taken into account.

Since 1914, additional points are credited separately to cows for butter production: viz.: for an annual yield of 100 kg. of butter, 1 point; for 125 kg and over, 2 points; for 150 kg and over, 3 points. Cows of less than 5 years of age received an allowance of 5 kg. of butter. The production of the last year of testing or the average of the last two years is taken into account.

IV. — STUDIES ON CONFORMATION IN RELATION TO MILK PRODUCING CAPACITY IN CATTLE (1). — Taking as his basis a large series of data collected by the American Jersey Cattle Club on the scores of cows inscribed in the Registry of merit, GOWEN has compiled a table giving the mean score and milk yield as scored by 19 different judges and also the mean annual milk yield of these groups of cows. In a second Table, he gives the standard deviation for the two average groups and in a third, the correlation between the score and the milk yield as shown by 19 different judges. The average correlation coefficient is 0.246. It is negative in 2 cases, and positive in all the others (leaving out the negative cases), from 0.027 ± 0.104 to 0.614 ± 0.067 .

These figures show the great influence of the personal equation of the cattle judge. Cows giving approximately the same milk yield have a difference of 6.5 ± 0.6 points on score according to the decisions of two individual experts. No particular association is shown to exist

(1) See R. Oct. 1920, No. 1012. (Ed.)

between the variation of each judge in his total score and the variation of the cattle he judged as to their milk yield; there is on the contrary, a certain parallelism between the scores of several judges for different groups of cattle.

The judges differ not only in the mental scale by which they make their judgements, but also in their capacity for correct classification as regards milk yield and butter-fat percentage. Of the 19 judges considered in this paper, 9 were good, 8 mediocre and 2 inefficient, as giving better scores to low-producing cows than to high producers, and responsible for the two above-mentioned negative correlations. The average ability of this group of judges to score for milk yield is about 25 % better than that of the average trained dairyman.

There is no relation between the average score given by each judge to his group of cows and his ability to value them for milk production. When it is noted that the mental scale of each judge differs considerably this fact is significant. It shows clearly why two equally good judges of cattle may place their cows several points apart, while at the same time, they keep the cows in the relative order of milk yield.

Cows whose average milk yields are larger or variable are more easily judged than those with a lower or uniform milk production. The scores of good judges show more variation than those of inferior judges.

Only about one man in two can pick out a good milker at sight. It is therefore necessary for a judge not to rely entirely upon his ability to select cattle by conformation, but to test the actual milk yield by weighing the milk. Even if the milk production of one week only is tested, the figures obtained are nearly twice as valuable as an indicator of milk production over a long period as a judgement based on the conformation of the cow, although this conformation be judged by men of considerable ability.

V. — JUDGING CATTLE AT SHOWS. THE IDEAL TYPE OF CATTLE FOR BELGIUM. — The new method of judging cattle by points, instead of by general appearance, has not given the results expected in Belgium.

Seeing the great importance that the points method may have for the progress of cattle-breeding on Belgium, MARCQ and MAHY have made a study of its adaptation to judging Belgian breeds and consider; a) the systematic use of a scale of points; b) classification into categories; c) the publication of the points of the classification with a view to the professional education of the breeder; d) the use of measurements at Shows; e) the ideal type of cattle for Belgium.

a) Animals which have already been subjected to two preliminary tests should alone be admitted to examination. The first of these tests eliminates all cattle that are not entered in the Herdbook, or (in the case of cows) are not provided with a milk production certificate, and of which the body-measurements (such as height, circumference of chest), do not correspond with those of the type (to be determined according to the agricultural district); the second excludes all animals which are not of the required type: are unsuitable for breeding purposes.

es; are too fat, or show any defect in conformation that should be eliminated from the breed.

The authors advise: a jury of 3; a percentage-card with the marks: 10 perfect; 9 very good; 8, 7, 6 good; 5 tolerably good; 4 fair; 3, 2, 1 mediocre; 0 poor; the use of the simplest forms owing to the lack of uniformity in the Belgian breeds. On the strength of their personal experience they suggest the form reproduced in Table III.

TABLE III. — *Form used in Belgium.*

Judge No.
Bull No.

Maximum		Coefficients	Number of points		Products
			Out of 10	Out of the maximum	
40	Required type conformation capacity and weight	4			
10	Line of back	1			
20	Pelvis and buttocks	2			
10	Chest (girth and flanks	1			
20	Limbs (including shoulders, equilibrium gait	2			
Total obtained out of 100					
To be subtracted from excess of fat (from 1-10)					
Accredited total out of 100					

The form for the cows differs from that used for bulls, in as much as 10 points are added to the 3rd and 5th note, and 20 to a 6th; udder and teats.

Another model form gives a summary of the decision of the 3 judges and is the final opinion. It is not at present possible to credit cows with points for pedigree and tests of milk production. High points are given for the required type, this being necessary in the case of breeds with irregular variations.

b) In classing cattle, the number of prizes and of animals to be placed in each category should not be settled beforehand, for both should depend upon the number of good cattle entered. The total sum of the prize-money can, however, be fixed in advance, and also the number of classes and the proportion between the value of the prizes offered for each class: for instance the 1st prize may be four times, and the 2nd twice as much as the 3rd.

In order to draw attention to the type of animal desired, it is well to give one or more diplomas of honour to exceptional animals in the 1st Class.

c) The points accredited to the prize cattle should be written on large placards to be placed behind the prize-winners.

d) The best type cannot be determined solely by means of body-measurements, which are, however, very helpful to the judges in forming an opinion of the conformation of the animals. As a model of a form based on measurements, the author reproduces the one adopted in Switzerland, where long experience has made it possible to determine fairly approximately the ideal measurements.

TABLE IV. — *Measurements and Points Card used in Switzerland for Bulls of the Red Pied Breed.*

Age of the animal examined

cm.	% (1)	Good measurements		Part measured	Maximum points	Points scored
		3 years old and over	1-3 years old			
		43-46	41-44.5	Chest: height		
		43-46	43-45.5	" depth		
		30-33	28.5-32	" width		
		32-35	32-35	Length of pelvis		
		31-34	30-32.5	Width of hips		
		30-32.5	30-33	Coxo-femoral width		
		Etc.		
			
			

(1) body-length 100.

The form for cows gives the standard measurements for animals 2 years of age and for those of 5 years old and over.

As an example of model Shows that have proved the fallacy of the idea, very commonly met with among breeders, that conformation and a high milk yield are antagonistic, the authors mention those held in the Department of Seine-Inférieure (France) (1).

e) The fact that the same prizes are often awarded at Belgian Shows to animals of very different type proves the lack of a uniform standard among those responsible for cattle-breeding.

The author brings out the necessity for determining the ideal type of cattle for Belgium; he discusses the required characteristics which should be: good conformation, great capacity for milk and butter-production, fairly early maturity.

This type occurs more or less frequently throughout the agricultural region, but the animals differ in size and in secondary ethnical characters, hence the defects and good qualities of the cattle are determined

(1) See R. Dec. 1921, No. 1256. (E.A.)

by regions, the average measurements of the animals being compared with those of the standard type.

It is thus possible to compare the measurements of the cattle of the different agricultural regions, and by this means, to deduce their characters, as has already been done for Flanders by Prof. ZWAENEPOEL, *Annales de Médecine vétérinaire*, 1914. In this way, the authors have discovered that the Condroz cattle have a longer croup than the Herze cattle.

When the best average weight of an adult animal in good condition has been determined for a given region, the most economically satisfactory chest circumference to be taken as a type is that expressed by CREVAR's formula: $P = 80 C^3$, where P is the weight and C the circumference of the chest.

VI. — JUDGING COWS FOR MILK AND BUTTER PRODUCTION. — In October 1920, the Municipality of Lisieux (Department of Calvados, Normandy), opened a competition for milch cows. The first day the competing animals (46) were examined as regards their conformation by 3 judges who used percentage forms; in the evening, the cows were thoroughly milked; the next day the milk from each of the 3 milkings of the day was weighed and analysed according to GERBER's method.

COLOMBE compares and discusses the results thus obtained and shows that there is not sufficient parallelism between the number of points accredited to the cows and their actual milk and butter yields. On the whole, however, the highest points were given to cows which gave the largest amounts of milk on the following day, and no poor milker was scored high, or *vice versa*; the same cannot however be said for the butter production.

These results prove that no conclusion as to butter-producing capacity can be obtained from external appearance or empirical characters.

The author therefore proposes that the examination of cows at shows should be divided into two different parts, and entrusted to two sets of judges, the first part consisting of an examination of the general conformation of the animal, the results being entered on a simple form, whereas in the second, the characters of production which it is desired to improve should be considered and expressed by points multiplied by a coefficient and entered on the preceding form in order that they may be included in the total number of points awarded. F. D.

456 — Wintering and Summer Fattening of Cattle in North Carolina, United States. — FARLEY, F. W., and PEDEN, P. T. (Animal Husbandry Division, Bureau of Animal Industry) and CURTIS, R. S. (North Carolina Experiment Station), in *United States Department of Agriculture, Bulletin No. 954*, 18 plates, figs. 5. Washington 1921.

In the autumn of 1913, the Bureau of Animal Industry of the Department of Agriculture of the United States, in collaboration with the Agricultural Experiment Station of North Carolina, began a series of experiments in feeding beef cattle in the county of Haywood (North Carolina), which is the western part of the State and where most of the cattle reared are destined for beef production.

The work lasted for 6 years, and the results of the experiments of the last 3 years have already been published (1); those of the 3 last years form the subject of the Bulletin analysed.

In each group of experiments there were 17 to 40 calves of over a year old. The average duration of the winter feeding was 126 days beginning on December 12; the period of summer grazing lasted on an average 180 days. The lots fed mixed hay throughout the winter received on an average during the 3 years, 5 kg. of hay per head and per day; they lost 22.7 kg. of live-weight during wintering and gained 130 kg. during the whole course of the experiment, viz., in 266 days.

The lots fed all the winter on the ration of 12.25 kg. of maize silage per head and per day lost 18 kg. of live weight during the winter, and gained 4 kg. during the whole period of the experiment.

The lots that were fed throughout the winter on maize silage + maize stalks + hay, consumed 6.9 kg. of the maize silage + and 2.8 kg. of the maize stalks and hay per head and per day. They lost 35 kg. of their weight during the winter, but increased 119 kg. in the whole period of the experiment.

The lots that grazed during the winter on deforested land and received little mixed hay or maize stalks and straw during the short time the ground was covered with snow, lost 13 kg. of weight during the winter and gained 138 kg. during the whole experiment.

The lot fed all the winter (for one year only), on maize stalks + hay + straw, consumed 4.5 kg. per head and per day during the winter; during this period they lost 29 kg. of live weight and gained 128 kg. during the whole time the experiment lasted.

It was found that the cost of the food and the increase in live weight were on an average about the same, whether the cattle were fed throughout the winter on maize silage, or mixed hay. The ration maize silage + maize stalks + hay was much less expensive than mixed hay and maize silage alone. Winter grazing was the most satisfactory method of feeding, on account of its cheapness and the increase of live weight obtained during the year. The authors also give rules for laying down meadows to be used as winter pasture.

The general average cost of feeding for the 4 winter months was about half the feeding cost for the whole year.

The mean cost per quintal of increase in live weight in the case of all the animals used in the experiment was 30 % higher in spring than in autumn. In the spring, the average loss of live weight was 6.5 % calculated from their weight in the preceding autumn.

7 - **Sheep Breeding in Syria and Cilicia.** — *Haut Commissariat de la République française en Syrie et au Liban, Notes sur l'élevage du mouton en Syrie et en Cilicie*, 55 pp., 3 appendices. Beyrouth, November 1921.

These notes have been compiled by E. ACHARD, Head of the Agricultural service of the High Commissariat from information collected by

(1) In *Bulletin* No. 628, U. S. Department of Agriculture, summarised in R. Feb. 1919, p. 227. (Ed.)

himself and from documentary evidence supplied by General MARTY in Cilicia, PAVIE and DJERRAHIAN for the Government of Aleppo, Com^{te} LA BOULANGER, Com^{te} DEVAUX, and H. RAMIZ MAKHZUMI for the Government of Damascus, Capt. MIEG, BRAIDY, ARSLAN, and NOUR for the Government of Great Lebanon, Col. NIEGER for the Territory of the Alaouites, CAYLA for the Sandjak of Alexandrette, and DUMONT the Chef d'escadrons for the sandjak of Djebel Bereket.

Syrian livestock consists chiefly of sheep, goats although much fewer in number coming next.

Syrian sheep belong to different varieties of the Asiatic breed (*Ovis aries asiatica*). They have the characteristic masses of fat on either side of the tail (fat-tailed sheep).

In some regions e. g. Turkestan, these masses of fat attain the weight of 16 kg. In Syria however they never appear to exceed 6 kg.

These accumulations of fat, which are no doubt a reserve stock, may disappear if the animals are reared for several generations on fertile land e. g. the civirdjik variety in Anatolia and the arab in Algeria.

The fleeces of the lambs of certain breeds supply a fur comparable to Astrakan (Karacul).

VARIETIES. — The most widely distributed variety is the "awass" which is the name of a nomad tribe of the Euphrates by which it is bred. These sheep are met with in Mesopotamia, Syria and Lebanon, where they are kept by the nomads. There are two sub-varieties: the "awass baladi" and the "awass deiry" of the region of Deir er Zor.

The height of the average "awass" sheep is 0.70 m. and its length varies from 1 m. to 1.10 m. The fleece is white though occasionally there are patches of black on the neck and head, and sometimes coffee-coloured animals are to be seen. The wool is straight and not much appreciated on the European markets; the first shearing is the best. When in yolk, the fleece weighs about 2.250 kg., but it loses 50 % in washing. The staple is from 0.15 m. to 0.18 m. in length. These sheep are good walkers, sometimes travelling as far as 400 km., they are very resistant to disease and variations of climate, but are susceptible to thirst and cannot find food in winter if the ground is covered with snow.

They fatten well (producing 30 kg. of fairly good mutton at the age of 3 years), and are good milkers.

In the Government of Aleppo are found: the "moor" variety (at Erzeroum), height 0.75 m.; the rams, unlike the ewes, have a straight forehead. The locks of the fleece which is of a dark red colour, are 0.12 m. long. The moor sheep produces from 30 to 35 kg. of mutton. It suffers from the heat in Syria for it cannot be said to be properly acclimatised.

The "brezi" variety bred by the Kurds, 0.70 m. in height; forehead straight, fleece white, wool straight.

In the Homs-Hanca region are found:

The different "awass" varieties. The *awass deiry* type, called "tchfalich" in Lebanon, and "djefeyli" in Cilicia, is 0.60 m. in height.

.80 m. in length and has no horns. Its wool is little valued and opinions as to the merits of this sheep differ in the various regions.

The "*hamra*" variety, native of Kurdistan, with red fleece.

The "*avijé*" variety.

The "*brasieh*" variety, tall, hornless, white. The "*tchoum*" and "*carha*" varieties.

In the territory of Great Lebanon, there are: the two types of the "*awass*" variety which seems to have improved somewhat as a result of better feeding.

The "*herrick deraa*" variety which is apparently the "*dziziré*" of Cilicia. Tall, fleece white, hairy parts thick, head and neck black; hornless, cotton of average quality, shows little resistance to disease.

The "*kerbalieh-hamra*" variety is distinguished by its height, chestnut fleece and hairless tail; it would appear to be the same as the "*bach-kalé*" of Cilicia and is regarded as one of the finest breeds.

The "*tchafaliek*" and "*moor*" varieties.

In Hauran, the "*awass*" variety alone is kept. In the territory of the Jaouites, 50 % of the sheep belong to the "*jallahi*" breed (which is considered indigenous); the animals are small, weighing 45 kg. (when dressed, the yield is 50 %), 40 % belong to the "*awass*" breed and the rest represent different varieties.

The "*moor*" sheep is predominant in the Alexandrette "sandjak", its fleece is often white. This variety fattens well, yielding 50 to 60 % when dressed and it is very resistant. In the sandjak of Djébel Bereket, we found (in order of merit), the "*melemendji*", "*caramanli*" and "*ain-nli*" breeds the 2 latter are also predominant in Cilicia.

SHEEP-BREEDING. -- Sheep are reared both by the stationary and the nomadic tribes, the latter possessing the greater number of animals. The flocks raised by the stationary tribes live throughout the year on fallow-land or stubble fields or else travel, according to the pasturage that is available in the district.

Sheep-breeding is not making progress and in certain districts it may even be said to be losing ground owing to the great decrease in the flocks (amounting to 80 % in the region of Alexandrette), which were used for provisioning the Turkish and German troops during the military operations in the country. Any increase in the number of sheep is checked by the scarcity of summer watering places; in autumn and winter the animals are in such a weak condition that they are easily affected by unfavourable conditions of weather. Immense tracts could be utilised for sheep-breeding if the example of South Algeria were followed and numerous watering places made for the flocks. In this way, certain districts might be turned to good account, which at present owing to the shortage of agricultural labour are unlikely to be cultivated for many years.

Epizootic disease is also partly responsible for hindering the development of sheep-breeding; although in the case of stationary flocks, it should be relatively easy for the veterinary service to establish adequate control,

while by restricting the wanderings of the travelling flocks to certain districts, all danger of thus spreading infection could be avoided.

The sheep-breeding industry is well worth development in Syria, for the climate allows the animals to remain in the open throughout the year while the different products of the flock can command a good market.

SHEEP-BREEDING CONDITIONS. — The animals are either reared by the owner himself who pays a shepherd, or else by several associated owners who entrust their animals to a shepherd with whom they share the profits on an agreed scale. The former method is employed chiefly among the stationary breeders.

The author describes the different forms of contract which vary according to district.

Co-operative breeding is fairly common in the Governments of Damascus and Aleppo; especially among the large landowners in the rural districts. The terms of the agreement vary considerably in different places and all forms are described in detail.

BREEDING. — As a rule, rams and ewes are used for breeding when 2 years of age, but this takes place earlier or later according to the district.

Animals are rejected for breeding purposes when they are about 5 years old though in some parts of the country, the age is fixed at 3 years, while in others it is extended to 7 or even 12 years e. g. in the territories of the Alaouites.

Rams are as a rule allowed to run with the ewes throughout the year, although in some districts they are kept apart from August to September. Mating begins in July and is sometimes continued until September 15. The number of ewes served by one ram varies considerably: in Lebanon, 15 rams are provided for 100 ewes, while in Cilicia (where it is said hand service is sometimes practised) a single ram is put to from 80 to 100 ewes.

Most of the ewes give birth to one lamb, twins being rare and triplets still more unusual. It is reckoned that 5.8 % of the sheep produce twins.

The mortality among the lambs varies with the climatic conditions, but never exceeds 5 to 10 %, and in average seasons the growth of the flock is estimated at from 50 to 60 %. Lambs are separated from their dams a few days after birth, and may then only be suckled twice or thrice a day and are at grass the rest of the time.

CASTRATION. — In Hauran and amongst the Alaouites, the young rams are not castrated, but if not required for breeding purposes, are sent at an early age to the butcher.

In Lebanon the operation is effected when the animals are 18 months old, and in Cilicia between the second and fourth month. In the district of Hama lambs are not castrated until they are a year old, as the Arabs consider that the operation stops growth. The usual method adopted is twisting the seminal cord, although in some regions the testicles are removed or crushed. The losses due to castration are computed at 1.3 %.

IMPROVEMENT OF THE FLOCK. — Selection and crossing are only carried out on a very small scale and unscientifically. As a rule, breeders aim chiefly at producing a tall animal, but whether this preference is governed by the desire of obtaining good walkers or larger fleeces is not very clear.

PASTURAGE. — The home keeping sheep-breeders send their sheep to graze on the fallow-land and stubble fields near the villages while the nomads let their flocks feed in the desert during the winter and spring, and in summer invade the districts occupied by the stationary population, where they are welcomed, as their sheep are supposed to manure the land. In some districts a payment varying in amount is made to the landowner.

In Syria, besides the mountainous districts, there are regions with meadows that are either perennial or can be pastured for the greater part of the year, e. g. the plain of Amk, lower valley of the Karasu, Harini, Harb; the plains of Akkar, and Bekaa, the banks of the Euphrates, the pastures of Harash etc.

SEASONAL AND GENERAL MIGRATION. — Seasonal migration is rarely followed, for most of the sheep-breeding is in the hands of the nomads; it is, however, practised in some parts of Great Lebanon and is very common in Cilicia where the flocks leave the plains in April and do not return until October. In the sandjak of Djebel-Bercket, there are nomad tribes that pass the winter in the plain and spend the summer on the hills.

The author gives a detailed account of the migration of the flocks and describes the manners and customs of the nomad tribes as well as their summer and winter camping grounds. Many of these natives breed camels as well as sheep.

LACTATION. — The lactation period varies from 4 to 5 months; the average milk production during the time being 500 gm., this low yield being probably due to irregularity in reeding. The sheep are generally milked once a day; the milk is rich in cream. Except in Cilicia, the milk is consumed by the family; much coagulated milk (yoghourt), butter and cheese being made. In any case, most of the products are used locally.

SHEARING. — Shearing begins on March 15 (Cilicia, Aleppo), and is generally continued through April, finishing in May in the upland districts. Owing to the mildness of the climate, the sheep are completely shorn. The animals are not washed before shearing and the weight of the fleeces in yolk varies between 500 gm. (Cilicia), and 2.5 kg. (Hama). The value of the wool varies with the different breeds.

DISEASES AND PARASITES. — The diseases that have been identified in Syria are: bacterial anthrax, known as "thal" in Homs-Hama, "tehaïel" in Hauran, "pohal" in Lebanon, and "hamra" among the Alaouites.

Symptomatic anthrax sometimes occurs. No serious attempts at treatment are made.

Foot-and-mouth disease, called "tibae"; the infected animals are isolated and their hoofs covered with tar or carbolic acid;

Scab, called "djedri"; this disease sometimes attacks 50 % of the flocks.

Vermineous bronchitis, known as "dondel el chaar"; distomatosis, called in Arabic "tbou donedar"; "mirara" which appears to be piroplasmosis;

Sarcoptic and psoroptic mange ("djarabe"); the diseased animal is shorn without cutting the skin, washed in soapy water and covered with an ointment consisting of equal parts of tar, sulphur and oil;

The fever called "errojet" is apparently due to flatulence;

Foot-rot which is treated with tar, sulphate of iron baths and various herbs.

Pasteurellosis, contagious pneumonia, jaundice and fleas. Other diseases are rife but cannot be accurately diagnosed.

TRADE IN SHEEP AND THEIR PRODUCTS. — There are three chief branches of trade.

- 1) Importation from the neighbouring region;
- 2) Exportation to the Islands of the Archipelago and Egypt;
- 3) Transactions connected with the local flock.

Most of the imported sheep come from Mesopotamia; but this trade has considerably decreased since the War. The animals are sent overland to their destination and details are given of the different routes.

Exportation is very limited and chiefly confined to Egypt and the Islands of the Archipelago.

Most of the meat consumed in Syria and Cilicia is mutton and goat's flesh. At Beyrout the number of sheep, lambs and goats slaughtered in 1920-21 was 60,000. At Aleppo the total number slaughtered was 210,000, of which 100,000 were lambs.

In Lebanon, sheep are fattened for home consumption. In 2 or 3 months the animals weigh from 60 to 80 kg. Their flesh is made into "kawarma", a mixture of fat and meat used as provisions for the winter.

The wool loses at least 50 % of its weight on washing. The fleece of the animals sent to the butchers' are also put on the market, but fetch 20 % less than shorn wool.

When the wool has been washed and sorted, it is packed for export.

The wools of Syria are classed under the heads of:

White, grey, black fleeces.

White, grey, black pelts.

Yellow "clips."

The latter are the ends of the fleeces and sell for 20 to 30 % less than the white pelts.

Before the War, the United States were the largest importers of Syrian wool, most of it now (50 to 55 %) goes to France.

The wool that remains in the country is used for making a kind of felt known as "libbadé" (the process of manufacture is here described) ropes, cord and sacking.

A good deal of butter used to be exported, but as exportation from Anatolia is at present impossible, all the butter made in the country of the years has been consumed locally. The much vaunted Aleppo butter for the most part made in the adjacent districts and brought to the town to be refined. A description of the process is given.

In 1920, 1500 *kantars* of 250 kg. of butter of the value of about 5 500 000 were produced in Hama. Before the War Aleppo sold annually 2 billion kg. of the value of some 4 million fr. Owing to the interruption of all commerce with Anatolia this trade has now decreased 50 %.

The district of Aleppo, properly so-called, produced in 1920 the same amount of butter as in 1914, or 20 % of the product that passes under the name of Aleppo butter. The average price is at present 20 fr. per kg.

The sheep-skins are either used locally or exported. There are tanneries in Syria at Aleppo, Antioch, and Zahlé and an account is given of the methods employed.

Skins for export are only slightly salted and dried; most of them come from the abattoirs. Previous to the War, Aleppo exported 250 000 sheep-skins but the number has now fallen to 100 000.

The residuum is exported (in the form of salted intestines) to Germany and Austria, while the horns furnish material for a local industry.

Some statistical data are given in order to complete this study and it is stated that, though it is very difficult to obtain reliable figures the number of sheep may be estimated at 10 466 346. P. C.

8 - Fertility in Shropshire Sheep, in the United States. — ROBERTS, E., in *Journal of Agricultural Research*, Vol. XXII, No. 4, p. 231-234. Washington, October 1927.

HEAPE in 1899 made the statement that in some breeds the younger ewes bear fewer twins than the older.

CARLYLE and MAC CONNET conclude from their observations, made in 1902, that ewes from 3 to 4 years old produced a larger percentage of lambs than younger or older ewes and also that 1-year-old rams were less prolific than 2 or 3 year old rams. The same conclusions were reached by HUMPHREY and KLEINHEINZ from a study of the records of the Wisconsin flock. JONES and ROUSE reported in 1920 that in the case of sheep the percentage of twins increased with age up to 5 years, after which there was a marked decrease.

The author has studied the influence of age and season upon fertility of the American Shropshire sheep. His source of data is the American Shropshire Sheep Record in which he examined 19 367 entries.

AGE OF EWE AND FERTILITY. — The percentage of multiple births increases with age up to 4 years and remains fairly constant for 8 years.

THE AGE OF THE RAM AND FERTILITY. — The age of the ram has no influence on the percentage of multiple births.

TIME OF BIRTH AND TWINNING. — HEAPE, who collected information from flock masters, states that 55 % of them reported that twins are usually born early in the lambing season. The author has found that the percentages of multiple births are 43.1 from January to March, and

36.7 from April to July. In the hope that additional information might be obtained, a study was made of the Dorset breed which produces a large number of young in the autumn. It was found that the percentage of multiple births was highest in the spring, being 48.2 from February to June inclusive as against 34.9 for the other months. F. D.

459 - **Lamb-Fattening Experiments in the United States.** — I. HAMMOND, J. W. Green Forage Crops and Corn for Fattening Lambs, in *Bulletin of the Ohio Agricultural Experiment Station*, No. 340, pp. 35-99, Tables 28, figs. 16, Wooster, Ohio, 1920.
II. PATERSON, A. M., and WINCHESTER, N. B., Lamb Feeding Investigations, 1919-1920 in *Agricultural Experiment Station, Kansas State Agricultural College, Manhattan, Kansas Circular* 88, pp. 6, fig. 1. Topeka, 1921.

I. TEMPORARY PASTURES AND MAIZE GRAIN FOR FATTENING LAMBS
— 1st Experiment. — Comparisons were made between: 1) meadow grass and colza; 2) grazing alone and grazing + maize grain; 3) grazing and stall feeding, no grass being given.

2nd Experiment. — In this experiment comparisons were made between 1) meadow grass, and rye, clover, and rape which were grazed successively; 2) grazing alone and grazing + maize; 3) grazing and stall feeding. In addition, the effect of the ration upon parasitic infestation was also studied.

3rd Experiment. — The three comparisons made in the 2nd experiment were repeated and the development of pure Merino lambs compared with that of hybrid Shropshire × Merino lambs.

4th Experiment. — Comparisons were made between the different rations of maize given as a supplement to grazing on rape, and the comparison between the Merino and the Shropshire × Merino lambs was again repeated.

The experiments were carried out on the South-Eastern Test Farm at Carpenter, Ohio. The fields of meadow-grass, owing to the character of the soil, were not of the best quality.

In Experiment 1 the average initial live-weight of the lambs was about 241 lb.; they were kept on grass for 131 days dating from June 11. The average daily increase in live-weight for the lot kept on meadow grass was 0.11 lb. per head, while that for the lot kept on rape was 0.113 lb. the increase per hectare was, however, 48 lb. and 214 lb. respectively.

In experiments 2 and 3 the average initial live weight of the lamb was about 33 lb. In the 2nd experiment, the average daily gain in live weight of the lot kept on meadow-grass was 0.34 lb. during the 153 days dating from May 11, and that of the lot grazed successively on temporary fields of rye (8 days), meadow-clover (48 days), and rape (97 days) was 0.40 lb.

In experiment No. 3, the lambs grazed for 160 days dating from May 5. The average daily gain in live weight was 0.175 lb. on meadow-grass, and 0.24 lb. for the lot kept successively on rye (22 days), meadow-clover (36 days) and rape (102 days). As compared with grazing on meadow grass (experiment 1), grazing on rape gave a higher daily increase in live weight of 2.73 % per head; grazing successively upon land under different

orage crops gave an excess increase of 19.79 % in experiment No. 2 and of 33.06 % in experiment No. 3.

In experiments 1-2-3 one acre of rape produced the same increase in live-weight as 5.04; 9.25; 8.19 acres of meadow grass respectively during the time the animals were left to graze.

In Experiment 1 the land under rape supported 40.3 lambs per acre for 131 days, and produced 240 lb. or increase in live-weight per acre. In experiment No. 2 it supported 22 lambs per acre for 77 days and produced an increase in live-weight of 185 lb. In experiment No. 3 there were respectively 60 Merino lambs per acre for 77 days, and an increase in live-weight of 203 lb. per acre; 97.5 Shropshire × Merino lambs per acre for 25 days and an increase in live-weight of 166 lb. per acre.

If the value of the land under rape is estimated at three or four times that of meadow-grass pasture, the cost of production per lb. of live weight is about equal.

The rape-fed lambs fattened better and sold at a higher price per kg., their yield as butcher's meat was also higher.

The results of the three experiments show that rape is an excellent forage plant for fattening lambs, especially in districts where good permanent pastures are rare. A temporary rape meadow can also often be used with advantage to supplement meadow-grass pastures during the summer when they are probably dried up, uninviting and infested by gastro-intestinal parasites left by the sheep.

As regards the effect exercised by the pasturage upon parasitic infestation, it was noted in experiment No. 2 that almost the same number of stomach-worms were present in animals turned out on to natural meadows, as in those that had grazed on temporary pasture land. The first had, however, the larger number of intestinal nodes.

The half-bred Shropshire × Merino lambs gave per acre of land under rye or meadow-clover, a larger increase in live-weight than the Merino lambs similarly fed. The results varied, as regards the animals kept on rape, sometimes in favour of the half-bred lambs, sometimes in favour of the Merinos. The half-bred lambs reached a higher degree of final fattening.

4th Experiment. — This took place at the Wooster Experiment Station (Ohio) and was carried out in order: 1) to determine the economy of giving a whole or half ration of maize as a supplementary food for lambs kept on rape fields; 2) to compare Shropshire lambs with half-bred Shropshire × Merino lambs as regards the cost and character of the live-weight produced by grazing on rape and the rate at which it is obtained. For this experiment 6 lots of 10 sheep each were chosen and the animals used in the preceding experiments, Nos. 2 and 3, served as control lots for the following years. Feeding a supplementary maize ration augmented the increase in live-weight: this increase was 11.5 % the first year, and 35.5 % the next, in the case of the lots kept on the meadow-grass field; and 12.6 and 21.1 % for the lots on the fields planted with other crops;

in addition, the dressing-yield and the value per lb. of live weight increased in all the cases.

The experiments at Wooster were made in 1917 with improved but not pure-bred Shropshire lambs, of an average initial weight of about 53 lb., and with half-bred Shropshire x Merino lambs of an initial weight of some 46 lb. Both lots were kept on rape and divided into 3 groups receiving respectively: a whole supplementary ration of maize (i. e. the whole ration that could be consumed in one morning); half a supplementary ration (what they found on the temporary pasture in the case of the control group). The average daily increase in weight per head was 4.5 oz. in the case of the Shropshire, and 5.3 oz. for the hybrid lambs in the control groups, as against 5.0 oz. and 5.3 oz. respectively in the group receiving the supplementary half ration, and 5.4 oz. and 5.5 oz. in the group given the whole supplementary ration. There was practically no difference in the final degree of fattening, nor in the yield at the butcher's.

It is true that the half-bred lambs had a slight advantage as regards rapidity and economy in the increase in live-weight and the increase in weight per surface unit, but further experiments are necessary before this superiority can be clearly established.

II. — LAMB-FEEDING EXPERIMENTS IN IDAHO, 1919-1920. — The two sets of experiments described in the bulletin analysed were made for the purpose of comparing rationing with self-feeding and of determining the comparative value of several concentrated feeds.

First Experiment. — Five lots of 40 lambs with an average initial weight of about 55.7 lb. were fed as follows for 64 days beginning on November 2, 1919: 4 lots were given 1.25 lb. grain + 0.14 lb. linseed-oil meal in addition to lucerne hay and cane silage, the other lot were self-fed and consumed 1.40 lb. shelled maize and 0.55 lb. linseed-oil meal per head and per day. The last lot ate less bulky feeds than the hand-fed lambs, made 0.03 lb. greater average daily gain per lamb, fattened better and gave a higher dressing percentage (50.06). Of the other lots No. 2, fed shelled maize, gained daily 0.48 lb. per head, No. 5 fed shelled maize and given in addition stock tonic gained 0.47 lb., daily per head, lot No. 3 fed ground maize also gained 0.47 lb. daily per head, while the lowest daily gain per head was made by the lambs of lot No. 4 which was fed whole barley; the dressing percentage of this lot was also the lowest. The dressing percentage for the 4 groups was respectively 49.1, 49.5, 48.8 and 48.2.

Second Experiment. — This began on February 8, 1920, and lasted 30 days; 6 lots of 35 lambs each were used. The initial weight of each animal was about 73 lb. and the final weight about 88 lb.

The self-fed lot (No. 1) were given daily per head 1.52 lb. shelled maize + 0.49 lb. linseed oil meal + 1.05 lb. lucerne hay + 0.98 lb. maize silage and made an average daily gain of 0.55 lb. per lamb; the same average daily gain was made with the handfed lambs (lot 3). The daily ration per head of the hand fed lambs was:— shelled maize 1.10 lb. + linseed oil

meal 0.23 lb. + 1.07 lucerne hay + 2.10 lb. maize silage. The self-fed lot received more maize and less silage than the hand fed lot.

When linseed-oil meal was left out of the basal ration of the hand-fed lambs (Lot 6) the average daily gain per lamb was only 0.42 lb., whereas the gain of the self-fed lambs (Lot 2) given the same food was 0.54 lb., with the consumption of 1.62 lb. maize per head and per day.

The hand-fed lot (No. 3) fed linseed-oil meal made 0.01 lb. less average daily gain per lamb than those receiving 34 lb. maize gluten feed (lot 5).

Lot 4 which was only fed shelled-maize and lucerne hay made a daily gain of 0.47 lb. per head and fattened less than any of the others.

The feed required for 100 lb. gain was as follows:

Lot 1. 276.27 lb. shelled maize + 88.86 lb. linseed oil meal + 30.36 lb. lucerne hay + 177.88 lb. maize silage.

Lot 2. 301.77 lb. shelled maize + 195.27 lb. lucerne hay + 205.46 lb. maize silage.

Lot 3. 190.66 lb. shelled maize + 41.52 lb. linseed oil meal + 35.16 lb. lucerne hay + 382.27 lb. maize silage.

Lot 4. 225.66 shelled maize + 498.63 lb. lucerne hay.

Lot 5. 186.78 lb. shelled maize + 61.02 maize gluten feed + 191.70 lb. lucerne hay + 348.73 lb. maize silage.

Lot 6. 248.76 lb. shelled maize + 255.30 lb. lucerne hay + 468.85 lb. maize silage.

Fat lambs weighing from 80 to 85 lb. are in greatest demand on the market. Therefore lambs weighing around 55 lb. are the most profitable type to feed. The larger type of feeding lamb is not fat enough at 85 lb. and is too heavy to command a profitable price.

F. D.

50 - Swine-Feeding Experiments in Kansas, United States. — FERRIN R. V., and WINCHESTER, H. B., in *Agricultural Experiment Station, Kansas State Agricultural College, Manhattan, Kansas, Circular 89*, 10 pp. Topeka, 1921.

A COMPARISON BETWEEN BARLEY AND MAIZE AS A SUPPLEMENTARY FEED FOR PIGS ON PASTURE. — Forty pigs divided into 4 lots of 10 each, were used in this experiment which lasted 120 days, beginning from July 1, 1919.

One pig out of Lot 1 died. The average initial weight of the animals was about 37 lb. The rations fed and consumed are given in Table I.

These results show that maize grain is more satisfactory for fattening pigs than barley which is too bulky owing to the large quantity of hull. In the preparation of barley, grinding gives better results than soaking the grain, especially if the feed is to be given to young pigs.

THE COMPARATIVE FEEDING VALUE OF MAIZE AND LOW-GRADE WHEAT. — This experiment lasted 120 days beginning on September 15, 1919. Most of the pigs used had been running on lucerne pasture until the test started from which time they were fed in dry lots. Fifty pigs were secured for the experiment, and their average initial weight was about 40 lb. The rations fed and their relative efficiency are shown in Table II. It may be said that, given equal amounts larger returns are obtained from

wheat than from maize; hence if the prices are approximately equal wheat is to be preferred to maize.

TABLE I. — *Barley versus Maize for Pigs on Lucerne Pasture.*

Food	Feed required for 100 lb. gain			
	Lot 1	Lot 2	Lot 3	Lot 4
	lb.	lb.	lb.	lb.
Shelled maize	306.78	—	—	—
Dry ground barley	—	352.15	—	—
Soaked ground barley (1)	—	—	413.87	—
Soaked whole barley	—	—	—	433.01
Tankage	28.78	26.17	31.69	32.74
<i>Totals</i>	<i>335.56</i>	<i>378.32</i>	<i>445.56</i>	<i>465.75</i>
Relative efficiency of rations in % on basis of least feed for 100 lb. gain	100.00	88.69	75.31	72.01

(1) The soaked barley only remained in water from one feeding to the next in order to avoid souring.

TABLE II. — *Comparison between Maize and Low Grade Wheat in fattening Pigs.*

	Feed Required for 100 lb. Gain				
	Lot I	Lot II	Lot III	Lot IV	Lot V
	lb.	lb.	lb.	lb.	lb.
Whole wheat	390.06	—	—	—	—
Ground wheat	—	402.88	466.51	245.77	—
Ground rye	—	—	—	45.77	—
Ground maize	17.85	—	—	—	485.27
Tankage	—	19.30	—	—	22.23
<i>Totals</i>	<i>407.91</i>	<i>422.18</i>	<i>466.51</i>	<i>491.54</i>	<i>507.50</i>
Relative efficiency of rations	100	96.62	87.44	82.98	80.38

VALUE OF RYE AS A SUBSTITUTE FOR MAIZE. — This experiment was made on 5 lots of 10 pigs with an average initial weight of about 60 lb. it lasted 120 days beginning on September 15. The results given in Table III, show that in times of high-priced maize, rye if available can probably be used to a larger extent than hitherto. Some more palatable food should however be mixed with it.

GRAIN SORGHUMS COMPARED WITH MAIZE. — An experiment lasting 60 days and beginning on February 17, 1920. Two groups of pigs were used, one farrowed in the spring, and the other in the autumn. Each

TABLE III. — *Rye as a Substitute for Maize in Pig Feeding.*

Ration	Feed required for 100 lb. gain				
	Lot I	Lot II	Lot III	Lot IV	Lot V
	lb.	lb.	lb.	lb.	lb.
100 lb. rye	245.77	—	486.58	243.80	279.88
100 lb. wheat	245.77	—	—	—	—
100 lb. maize	—	485.27	—	243.80	—
100 lb. oat shorts	—	—	—	—	273.26
100 lb. tankage	—	22.23	23.60	30.48	—
Totals	491.54	507.50	510.18	518.08	553.14
Relative efficiency of rations . .	100.00	96.85	96.34	94.87	88.86

oup was divided into 4 lots of 5 pigs. The various lots were fed ground maize or sorghum, and tankage. The results, given in Table IV show that at sorghum grains, especially milo and feterita, are nearly as good as maize for feeding pigs and may possibly be better than maize for fattening purposes.

If sorghum is substituted for maize, more tankage is needed. The right quantity of tankage was fed in this experiment, viz., 3.7 % of the total feed consumed in the case of 150-pound pigs and 4.7 % in that of 10 lb. pigs.

TABLE IV. — *Effect of the Age of the Pigs upon the Amount of Feeds required for One lb. Gain in Live Weight.*

Age of Pigs	Initial weight	Maize ration per lb. gain			Feterita ration per lb. gain			Milo ration per lb. gain			Kafir ration per lb. gain		
		Grain	Tankage	Total	Grain	Tankage	Total	Grain	Tankage	Total	Grain	Tankage	Total
100	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
150	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
100	4.54	0.19	4.73	5.00	0.27	5.27	5.07	0.25	5.32	5.58	0.27	5.85	
150	4.25	0.15	4.40	4.09	0.17	4.26	4.53	0.18	4.71	4.76	0.17	4.93	

F. D.

51 — **Concentrated Pig Foods. Experiments made in France.** — DE MARSAY, Vte H., and BAUDOUY, in *Journal d'Agriculture pratique*, Year 85, Vol. 11, No. 45, p. 396, Paris, November 12, 1921; year 86, Vol. 1, No. 6, p. 122. February 11, 1922.

I. — From September 14 a lot of 14 pigs weighing 1067 kg. were given as much as they could eat for 20 days, during which time they gained in

weight 218 kg. representing a pecuniary gain of 4.30 fr. (cost of 1 kg. of live-weight) \times 218 = 937.40 fr. The cost of the food was as follows:

420 kg. manioc meal at 0.66 fr. the kg.	277.20
240 kg. barley meal at 0.70 fr. the kg.	168.00
100 kg. pea-nut meal at 0.56 fr. the kg.	56.00
700 litres whey at 0.05 fr. the litre	35.00
	<hr/>
	536.20

Gross profit: 93.40 fr. — 536.20 fr. = 401.20 fr.

Grain per pig and per day: 401.20 fr. : 2.80 = 1.44 fr.

II. — 85 rationed pigs given: 3 to 4 kg. whey + 1 kg. manioc. 1 kg. barley + 0.5 kg. pea-nuts, or a ration costing about 2 francs, also gave a good return with meat at the present price.

III. — A hundred pigs were fed the following ration: 500 gm. maize. 500 gm. sorghum + 1000 gm. palm-oil cake + 500 gm. pea-nuts + 200 gm. bone-meal + several litres of whey, distributed as follows: palm-oil cake, pea-nuts, bone meal, crushed sorghum mixed with whey and given water in the morning: the same ration in the evening: maize grain at midday. Sorghum fed whole is not digested well but is very digestible when either ground or crushed.

After 30 days the following results had been obtained:

Daily gain of unrationed pig fed maize (consumption 1.360 kg.) . . .	0.920 kg.
Daily gain of rationed pig fed maize (0.500 kg.)	0.668 "
Cost of feed of unrationed pig.	2.282 fr.
Cost of ration of hand-fed pig.	1.520 "
Daily profit of unrationed pig (at 4 fr. per kg. of live-weight) . . .	1.398 "
Daily profit of hand-fed pig.	1.152 "
Difference to the advantage of unrationed pig.	0.246 "

In all these experiments the cheapest concentrates obtainable were used. From the results the following conclusions may be drawn:

1) Nothing is gained by rationing pigs; it is much better, to give them food *ad lib.*, 2) At the present time it pays very well to feed pigs on judiciously chosen concentrates. F. D.

462 — **Apiculture in Cuba and the Purity of Cuban Honey.** — *Communication made to the Permanent Committee of the International Institute of Agriculture by Dr. F. F. PALCO, Delegate of the Republic of Cuba.*

Bee-keeping is very popular in Cuba, and recently on the initiative of the Reorganisation Commission of the National Agricultural Services of the Republic, a great deal has been done to develop in every way this branch of rural economy and to stimulate actively the improvement of the breeds.

The flora of Cuba is the richest and most varied in the botanical region of the Antilles and includes a large number of native species, as well as of species imported both from temperate and hot countries; it is therefore able to supply the bees with materials of excellent quality for honey-making. It is reckoned that there are over 50 species of honey-

ey-bearing plants in the island; of these some of the most important are *Aguinaldo blanco de Pascuas* (*Ipomoea sidaefolia* Choisy), which opens its flowers at dawn and closes them at three o'clock in the afternoon, and *Aguinaldo rosado* (*Ipomoea triloba* Lin.), from which the bees make the *Aguinaldo* honey which has a reputation for the most delicate and delicious flavour.

The State Agricultural Experiment Station has instituted a model apiary that has of late been much developed, and has introduced selected queens of Italian stock, in order to obtain queen-bees of first rate quality or distribution to bee-keepers who wish to improve their stock of the Caucasian, Carniola, and Cyprus breeds, for in this way very satisfactory results have been obtained. The Entomological Department attached to this Station has also created a Service for the protection of bees against their natural parasitic enemies, the insects belonging to the family of the *Galleriidae* (*Galleria mellonella* and *Achroea grisella*).

Apiculture is continually on the increase and is the source of a large export trade of Cuban honey which until quite lately was much appreciated in other countries.

Recently the purity of this Cuban product has been called in question in some European countries, and this has been the occasion of a very careful investigation on the part of the interested Official Authorities of the Republic. The results of this investigation are here set out for the information of the International Institute of Agriculture by the delegate of the Cuban Republic.

Since the analyses of the honeys from Cuba had led to different conclusions, some of the honeys being regarded in many countries as of undoubted purity, while in others, importation is being checked owing to the alleged presence of invert sugars as revealed by the furfural reaction, the Laboratory of Agricultural Chemistry of the Republic resolved to make a thorough investigation of samples of known genuineness and purity, in order to be able to determine conclusively the percentage composition and qualitative characters of the chemically inverted sugar and artificial glucose probably used in the adulteration of the honey. The system followed was with slight variations that adopted by the Bureau of Chemistry of the Department of Agriculture of the United States, the object being to discover some explanation of the different treatment given to Cuban honeys by the Custom-House Officials of certain countries.

This investigation revealed that the difference was the result of analysis according to two different systems. In fact when FIEHN'S hydrochloric resorcin method was adopted, the furfural colour reaction was obtained owing to the presence in almost all genuine Cuban honey of a substance, which by its special chemical action affects the reagent whereas no reaction takes place at all with BROWNE'S anilin acetate method.

The first phenomenon is explained by the fact, that as many of the apiaries are situated near the sugar factories in Cuba, large quantities of saccharose are frequently within reach of the bees. They collect the saccharose on their feet and deposit it on the comb, as has been found by

analysis carried out according to the FIEBE process. Saccharose has also been detected in the honey from apiaries near the factories, although it is not found in the product of those at a greater distance, as for instance in the honey from the Isla de Pinos. Thus the presence of this sugar must be regarded as a natural characteristic of the product. Further saccharose only occurred in very small quantities in the cases quoted, the amount never exceeding 0.25 per 1000.

The report prepared from the results of the investigations at the Laboratory of Agricultural Chemistry sets forth very graphically the data obtained, and shows that FIEBE's method for the detection of adulteration of honey gives misleading results in the case of the Cuban products and that the experiments carried out at the State laboratories of Cuba and of the United States alike have proved to demonstration the necessity for adopting the BROWNE process.

The Head of the Department of Chemistry of the Ministry of Agriculture of the Republic as a result of analyses made in the laboratories under his control, and of similar investigations made by the United States Bureau of Chemistry of the Department of Agriculture, and also taking into account the genuine nature of the samples analysed, has formulated the following conclusions.

First: Cuban honeys have a homogeneous chemical composition varying within very narrow limits and differing very little from the composition of honey from other countries.

Second: By far the greater part of Cuban honeys have the property of producing with hydrochloric resorcin a colour reaction that gives the erroneous impression that these honeys which have been recognised as pure, have been adulterated with chemically obtained invert sugars.

Third: In the light of these facts FIEBE's method should not be employed in the analysis of honeys made by Cuban bees.

Fourth: BROWNE's anilin acetate method should be exclusively recommended as the only sure test for Cuban honeys suspected of adulteration with invert sugars.

F. F. F.

463 - Treatment of "Acarine Disease" (Isle of Wight Disease), of Bees. (1) - ALLEN W., in *British Bee Journal*, Vol. XLIX, No. 2040, pp. 344-345. London July 28, 1921.

In his experiments in controlling Isle of Wight disease the author has found the fumes of ammonium sulphide to be most efficacious and quite innocuous to the bees. A pad of cotton-wool dipped in ammonium sulphide is introduced between the diaphragm and the wall of the hive, which is covered to prevent the escape of the fumes. Two days after treatment all the symptoms of the disease have disappeared.

(1) See R. July 1921, No. 748. Dr. RENNIE and his collaborators have stated the Isle of Wight Disease differs from the disease caused by *Nosema apis*. The agent is a mite *Tarsonemus woodi*, which invades the tracheal system of the bee. Dr. RENNIE suggests for this malady the name of acarine disease. (Ed.)

Allyle sulphide is equally efficacious, but is much more pungent, and very dear, whereas ammonium sulphide is cheap and easily procured.

F. D.

The Present Condition of Sericulture in Syria. — CROIZAT, in *Revue de Botanique appliquée et d'Agriculture coloniale*, Year II, Bull. No. 5; pp. 28-29. Paris, January 30, 1922.

SERICULT

According to a report by the author published by the Lyons Chamber of Commerce, the output of cocoons in Syria previous to 1914 was about 30 000 kg. 3 700 000 being produced in Lebanon and the Plain of Beha, 800 000 in the district of Antioch. These cocoons furnished 300 000 kg. silk, most of a very fine quality, which was destined for the French market. The mulberry was cultivated everywhere on a large scale. Silk-worm eggs were brought from France in refrigerators which made it possible to obtain fairly good products, although all modern methods of silk-worm breeding were totally unknown in Syria.

After the War broke out, no more silk-worm eggs arrived, the native "seed" produced worthless stock and finally the mulberry trees were dug up in order that food crops might be planted in their place. As a result there was a great reduction in the number of cocoons obtained. In 1919 it was only $\frac{1}{4}$ of the pre-War total in Lebanon although the importation of "seed" had been resumed, and had fallen to $\frac{1}{8}$ in the district of Antioch where native "seed" was still used.

G. A. B.

Observations and Researches on the Causes of the Persistence and Diffusion of Pebrine in Italy, notwithstanding the Selection of the Silk-Worm Eggs. —

MONTANARO N. (Istituto Bacologico, Portici), in *Informazioni seriche* Vol. IX, No. 3, pp. 34-39. Rome, February 5, 1922.

Although from the industrial point of view it may be said that pebrine has been conquered (for the silk-worm breeder is always sure of being able to obtain healthy eggs and he is not concerned whether the cocoons he obtains contain healthy chrysalids), the disease is still very widespread, and it frequently happens that all or most of the moths reared from sound "seed" contain the characteristic spores.

This can be explained by 4 hypotheses:

- 1) The selection methods do not give results sufficiently perfect to eliminate entirely, infected eggs.
- 2) Breeding from infected eggs, though forbidden by law still takes place.
- 3) The germs of the parasite possess greater powers of resistance to external surroundings than has hitherto been commonly supposed.
- 4) The disease may attack other insects and therefore persist independently of the silk-worm.

The author has tested experimentally the truth of the 4 hypotheses especially the first, and his results may be summarised as follows:

- 1) Of all the methods proposed for the elimination of infected eggs, PASTEUR'S is still the best. The negative importance of the male

in the transmission of the disease has once more been proved, for though in some experiments the malady was conveyed by the male insect, these cases were exceptional. Sound progeny can be obtained from *slightly* infected females. Thus the first hypothesis may practically be discarded.

2) One of the chief causes of the persistence of pebrine lies in breeding from uncontrolled "seed", or seed purchased from travelling dealers, or from abroad; frequently also eggs bred by the peasants are mixed with those bought.

3) The results of PASTEUR's experiments, although not always uniform, were sufficiently general to justify the conclusion that pebrine germs lose their infectious character after drying in the air. Several other experiments have shown, however, that they are endowed with considerable powers of resistance. HUTCHINSON found that the spores continued to live in a dry medium for over 5 months and therefore their life in a damp medium would probably have been longer. The author's experiments, which are not yet finished, confirm HUTCHINSON's statements. It is quite possible that other insects beside the silkworm harbour the pebrine parasite, in fact *Nosema bombycis* infects other Lepidoptera, such as *Gastrophaca neustria*, *Arctia caja*, *Attacus* (*Saturnia*) *pernyi*. F. D.

466 - The Use of Low Temperatures to destroy *Bombyx* Chrysalids. — DI TOCCO R. in *Informazioni seriche*, Vol. IX, No. 4, p. 57. Rome, February, 20, 1922.

As some silk-worm rearers have suggested the use of low temperatures for destroying the chrysalids of *Bombyx*, the author takes occasion to advise that none of the expensive apparatus required should be installed for the present, as with low temperatures the natural moisture of the cocoons cannot be absorbed as it is by storing, and the treatment is a lengthy one owing to the great summer heat, the high temperature induced by heaping up the cocoons, and the bad conductivity of the outer silk. The chief objection is however the uncertainty of the process.

Although silkworms themselves die at 8-10° C below 0° C, (SPALLANZANI), their eggs can resist, for a short time, much lower temperature (BONAFOUS, FRIZZONI, QUAIAT), and the chrysalids take no harm, even when exposed for successive generations to temperatures below -12° C. (This fact has been proved by the experiments of Prof. COLASSANI (briefly described by the writer) of which an account was published a long ago as 1879 in the *Rendiconti dell'Accademia medica di Roma*. F. D.

FARM ENGINEERING.

467 - Tractor or Motor-Plough? — SCHEMPF, in *Deutsche Landw. Presse*, No. 3 pp. 400-401. Berlin, July 6, 1921.

The author makes a comparison between tractors with motor ploughs after a consideration of the results of the tests at Zuffenhausen (Stuttgart).

In ploughing heavy land to a depth of 20-22 cm. the tractor appears

ed to be slightly superior to the motorplough. The furrow turned by the towed plough was better finished than the furrow made by the mould-boards of the motor-plough. The tractor also seemed easier to drive.

A 2nd test was made on very heavy, uneven land, where the tractor proved itself clearly superior to the motor plough, whose work was continually interrupted by hillocks between the mould-boards.

In the case of skidding, it was found that the wheels of the motor-plough when reversed were quite as liable to slip. With a tractor the difficulty can be better got over by the use of a chain or cable.

The results from the point of view of fuel consumption are not yet known.

G. B.

468 - One-Wheel Tractor, L' Hermite System. — WEISS E., in *Le Génie Civil*, Vol. LXXX, No. 6, pp. 133-134. Paris, February 1922.

An agricultural tractor should be able to turn on the field like a single-horse; it ought therefore to be as easy to drive as a horse-drawn vehicle.

L'HERMITE has followed these principles in the construction of his new model tractor. This tractor has one large driving-wheel only which can turn on the field; the motor engine forms with this wheel and the accessories, a complete machine that can be pivoted on a horizontal circular attachment. This attachment carries the connections for the machines, just as a horse's harness is provided with the means of linking up with the vehicle.

The only other movable part is the central driving-wheel; hence the strength of the tractor, and the suppression of the speed-gear. The gear-case is placed in the nave of the driving-wheel.

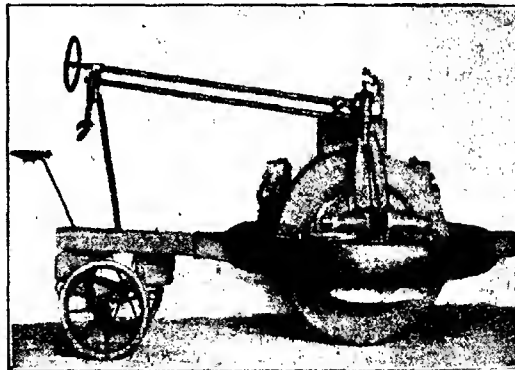
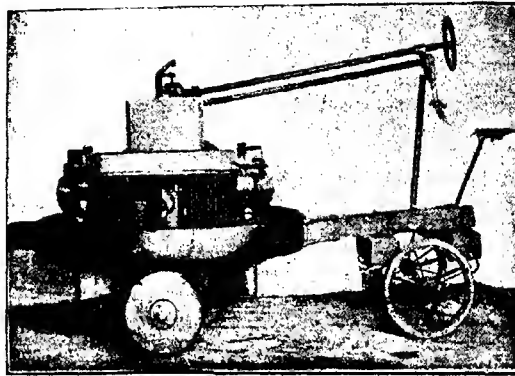
The engine is valveless, has 2 horizontal cylinders and the distribution is very simple. A hollow cylinder communicates in the centre with the carburettor; at each extremity, it has an oblique partition which during rotation, puts the pipes supplying the cylinder in communication both with the centre of the tube for the aspiration of the carburetted mixture, and with the exhaust. To compensate for side slip a trailing wheel of small diameter is added.

The cooler consists of small vertical tubes and detachable circulating linings that are easily replaced.

Attached to the frame are horizontal rollers supporting large horizontal circular attachment which entirely surrounds the engine as the harness envelops a horse; thus the driving-wheel can at once revolve *in situ* within it. Changes of direction can be effected as quickly as in the case of a horse, and the machine can go in either direction. The steering apparatus is of a simple character and the forward and backward movement as well as the speed control are regulated by a lever.

The tractor can turn within a radius of 1 m., and can be used with a two-way plough. The tractor is placed between the two series of shares, the frames of which are arranged symmetrically to the axis of the tractor which is also the axis of turning.

The driving wheel works parallel to the direction of the plough and change of direction is made after the reversal of the shares. A supporting-wheel is placed behind each plough to regulate the depth of ploughing. In short this tractor has been specially designed for agricultural work



One wheeled Tractor L'HERMITE.

P. C.

469 - "Massimo" Tractor, for Ploughing on Slopes. — CASTELLI M., in *La Macchina nell'Agricoltura*, Year II, No. 1, pp. 6-8, figs. 5, Milan, January 1922.

This tractor has 4 wheels; 2 driving-wheels at the back; 2 steering-wheels in front; motor-car type; runs on petrol; develops 25 H.P.; rigid suspension; all transmissions by means of gearing; weighs 2600 kg. when

ready for work. This tractor is especially adapted for ploughing in hilly country, on uneven ground with steep slopes up to 3/10: the steering mechanism oscillates with parallel movement; the back wheels are small with vertical displacement; transmission to the back wheels is effected by pinions engaging with an internal cog wheel attached to the wheel-body, the whole being enclosed and running in grease; reversible action; simple method of attachment.

Several experiments have been made with this tractor, and the results obtained were perfectly satisfactory.

F. D.

70 - **The Heavy-Oil Engine for Agricultural Purposes.** — MÜLLER B., in *Deutsche Landw. Presse*, No. 59, p. 439. Berlin, July 27, 1921.

The author demonstrates the advantages of this type of engine from three points of view of safety, easy handling and small cost of motor-power. Practical experiments have shown that it consumes 220 gm. only of heavy oil per horse-hour. This fuel is much less expensive than petrol or paraffin.

G. B.

71 - **Means of Attachment for Tractors to Farm Vehicles.** — *Deutsche Landw. Presse*, No. 45, pp. 342-343. Berlin, June 8, 1921.

The object of this apparatus is to enable ordinary farm-carts to be drawn by a tractor. After removing the pole, a bar connected by means of rods with the forecarriage is fixed on the front; in this manner, all the strain is transferred to the fore carriage.

G. B.

72 - **Windlass for Cable Ploughing which Automatically changes its Position in Two Directions.** — CASTELLI M., in *L'Italia Agricola*, Year 58, No. 10, pp. 305-309. Piacenza, October 15, 1921.

The author, who has invented the apparatus described in this article, proposes to use it for the intensive cultivation of flat and hilly country in which the present large cable-drawn tractors are unsuited. As compared with such tractors, this windlass provides the necessary traction force, at about half the cost for installation. It may be called a single engine funicular apparatus whose working is eased as no ploughing is done on the return journey (which is made twice as quickly as the outward journey, during which the actual ploughing is done), and by a considerable reduction in the length of the furrows.

The windlass-cart carries the engine which is preferably driven by electricity, the transmissions and 2 drums upon which are wound the working and the return cables; these move together and their movement is transmissible also to the chief trailing-wheels whose axis is parallel to the axis of the drum. If the engine is driven by electric power, the movement is only used in the field. In order to anchor the windlass-cart, a traverse or skid is lowered carrying nearly all the weight. Any longitudinal movement in the direction of the furrows is thus prevented, whereas transverse changes of position are rendered possible by the sliding of the skid over the ground. On the opposite headland is anchored a light return pulley which is easily moved by hand during ploughing.

An ordinary plough is used ; to this can be attached a roller with a guiding-lever which facilitates its return when empty. An automatic self-raising plough of the type used for tractors, but with some slight modifications can be employed. The plough when working is drawn directly towards the windlass, that is to say without any return or deviation of the rope which is therefore not liable to become worn.

As soon as the plough has reached the windlass, the driver reverses the movement of the drums and the plough at once begins to return; at the same moment, by the action of a small windlass also controlled by the engine, the patten supporting the windlass-cart slides along the headland changing its position by as much as the width of one or more furrows.

R. D.

473 - **Plough for the Rudolf Sack Tractor.** — *Deutsche Landw. Presse*, No. 55, p. 413. Berlin, July 13, 1921.

This plough is made with 3 and with 2 mould-boards worked in the first case with a rope, and in the second with a lever. The ploughing apparatus consists of an excentric that controls the nave of the land-wheel by means of a chain attachment.

G. B.

474 - **Notes on Implements for Motor-Ploughing.** — STENDEL, in *Deutsche Landw. Presse*, No. 43, p. 327. Berlin, June 1, 1921.

The author gives some information regarding the different W. D. implements and their use.

The W. D. motor-plough is provided with a 80 HP. engine and carries 5 mould-boards; a second type has an engine developing 35 HP and is fitted with 3 mould-boards. The W. D. tractor is of the caterpillar type; its engine develops 20 HP.

G. B.

475 - **Method of Fixing Mould-Boards on Ploughs, Deutsche Last-Automobilfabrik System.** — *Deutsche Landw. Presse*, No. 43, p. 327. Berlin, June 1, 1921.

The frame bearing the mould-board is fixed on the chassis in such a way as to be able to rise vertically, and slope backwards when the plough meets with any obstacle; two compensating springs control the displacement and bring back the frame into its normal position.

G. B.

476 - **Richter Hoe for Potato Ridging.** — *Deutsche Landw. Presse*, No. 35, pp. 268-29. Berlin, May 4, 1921.

In the present type of machine, the blades are adjusted to the slope of the sides of the ridges, by turning on a pivot inclined in the direction in which the machine is travelling. The new machine provides for a second movement, round a vertical axis. By this means, the blade is able to adapt itself both to the slope and to the height of the ridge, so that the edge is prevented from coming into contact with the plants.

G. I.

477 - **Working the Soil with a Disk-Harrow.** — BIPPART, in *Deutsche Landw. Presse*, No. 53, p. 400. Berlin, July 6, 1921.

The author examines the different kinds of work executed with a disk-harrow, or pulveriser. It is a mistake to use this implement in

the spring for working the soil to a depth of 15 cm. The mass of soil is too much disturbed and as a result of the contact of the earth with the air, the water evaporation is intensified which is very injurious, especially as the spring is generally followed by a period of drought.

When it is necessary to make a layer of granular soil on the surface of the ground, such as is obtained with a rotary plough, the disk-harrow brings about this result with the expenditure of less energy than any other implement. The author mentions other cases in which it can be employed: fallow land that has been ploughed in the autumn should be disk-harrowed in spring to decrease evaporation and hasten the germination of weed-seeds. The disk-harrow is well adapted for the destruction of weeds and also for breaking up stubble after cereal crops have been carried.

G. B.

- 178 - **Renniger's Apparatus for Cleaning Seeds.** — *Deutsche Landw. Presse* No. 33, p. 255. Berlin, April 27, 1921.

This apparatus is especially adapted for cleaning seeds such as those of the poppy, clover, etc. It consists mainly of a series of sieves of which the action is completed by rubbing-plates.

G. B.

- 179 - **Breite Potato Sorter.** — *Deutsche Landw. Presse*, No. 29, p. 222. Berlin, April 13, 1921.

The rotating type of potato-sorter requires a very long cylinder for satisfactory working. In order to diminish the length of the apparatus and make it easy to carry when sorting is done in the field, and also easier to store, the drum is so constructed as to be capable of extension while folding together bellow-wise.

G. B.

- 180 - **Carlson Straw-Press combined with Thresher.** — *Deutsche Landw. Presse*, No. 21, p. 163, Berlin, March 16, 1921.

The press is placed at right angles with the thresher and its hopper receives the straw from the shakers. Thus the axle of the guiding-pulley is perpendicular to the driving-shaft of the press. The gearing apparatus is patented; it consists of a frame that can be applied either to the right or the left side of the press. The pulleys altering the direction of the belt can be regulated both for height and direction.

G. B.

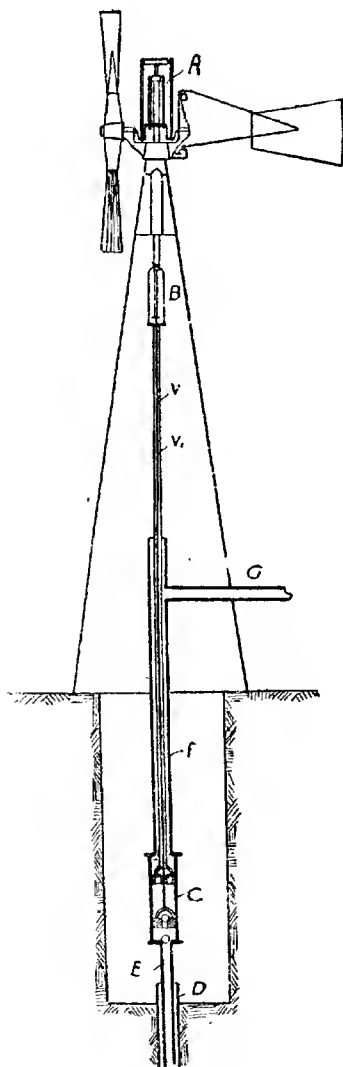
- 181 - **Automatic Distributor of Oats for Horses, Mische System.** — *Deutsche Landw. Presse*, No. 45, p. 343. Berlin, June 8, 1921.

This apparatus includes a regulator, a braked motor and the oat distributor. It works without springs, the oats falling into a vertical hopper into which they are poured by a horizontal transporting canvass set in motion by the mechanism.

G. B.

- 182 - **Double Stroke Wind Engine.** — *CONTR M., Revista de la Facultad de Agronomía y Veterinaria*, Vol. III, Part 3, pp. 294-306; figs. 5, Buenos Ayres, December 1921.

An improved type of ordinary wind-engine invented by Felix ROLDÁN and tested with complete success at the " Instituto experimental de Mecánica agrícola " of the Agricultural and Veterinary Faculty of Buenos Ay-



No. 482, Fig. 1.

*Diagram of the Construction of a
Double Stroke Wind Engine.*

A = mechanism.

B = guide for the two concentric
rods V and V1.

C = double stroke cylinder.

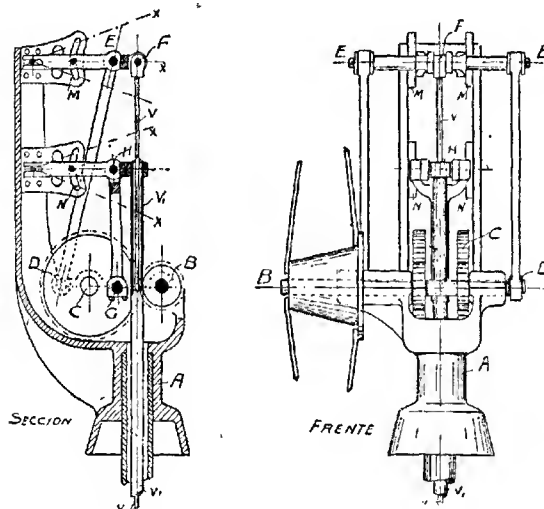
D = perforation.

E = suction-pipe.

F = elevation pipe.

G = discharge pipe.

res under the direction of the author. The improvement consists in the use of a double balance to control the working of 2 concentric piston-rods thus providing for a cylinder with double piston and hence with an up and down stroke, the one rod rising as the other falls. The weights of the rod and of the tube which acts as an external rod are equal and balance one another, thus obviating the difficulties caused in ordinary wind en-



No. 482, Fig. 2. — Mechanism of Double Stroke Wind Engine.

SECTION = Vertical section

FRENTE = Front view of mechanism.

A. cast-iron socket of armature. — B. axle of wheel and pinions. — C. counter axle of reducing cog-wheels. — D. insertion of external pinions which unite in axle F and communicate at F the motion of the rod V. — G. insertion of the double central axle communicating the movement to the other tubular rod V' by means of the oscillating arm H. The guiding-rods M and N. control the oscillating arms in order to obtain a perfectly vertical and centric movement of the rods; the dotted lines show the radius of action of each oscillating arm when in motion.

gines by the weight of the single rod. The water thus raised flows without interruption and given equal wind velocity, is about twice as much as that obtained with an ordinary single stroke wind engine.

The armature of the machine is placed as usual on the top of the tower, in order to impart the rotatory movement of the sails (see fig. 1, p. 572); the wheel, helm, and the regulator, or automatic device for stop-

ping the engine are of the ordinary type. The axle of the wheel (see fig. 2, p. 573), rests on 2 supports and carries 2 pinions geared with the two cog-wheels that reduce and transmit the movement. The simultaneous and inverse movement of the 2 concentric axles is obtained by 2 rods meeting at an angle of 180° . The external rods work on 2 arms at the end of the axle of the cog-wheels and the central rod is attached to an eccentric axle connecting the 2 cog-wheels; the 2 rods have the same stroke, but in opposite directions.

F. D.

483 - **A Chest of the Funke Type, to be used in Testing Milk.** — WEISDEMANN, in *Deutsche Landw. Presse*, No. 33, p. 355, Berlin, April 27, 1921.

The author gives a description of a case containing all the apparatus necessary, including the separator, for making a rapid test of milk. The case measures $54 \times 54 \times 36$ cm. and weighs 40 kg. The author has found this device very practical in use.

G. B.

484 - **A Mercury Vapour Current Transformer for use in the country.** — SIMON E., in *Deutsche Landw. Presse*, No. 17, p. 123, Berlin, March 2, 1921.

This apparatus transforms an alternating current into a continuous current. It is especially useful for owners of a continuous current electric plant who have the opportunity of connection with a central station having an alternating current. With the help of this apparatus, there is no necessity for change in the original installation. The author mentions several ways in which this current redresser can be used, and describes the cases where it can be employed with advantage.

G. B.

RURAL ECONOMICS

485 - **Farm Organisation in Bohemia.** — BRMLK (Director of the Institute of Agriculture Accountancy), in *Bulletin du Ministère de l'Agriculture de la République Tchécoslovaque* Year II, No. 4, pp. 25-27, Prague, Oct. 1 1921.

The Prague Board of Agriculture ("Conseil d'agriculture de Prague") in 1912 founded an Institute of Agricultural Accountancy whose duty it was to control, by means of accountancy, the farms with which it was associated. The farmer correspondents of the Institute supply their weekly reports on income and expenditure, fodder rations for the different domestic animals, and work done in the fields and on the farms. With these data as a basis, the Institute draws up the annual balance-sheet of the farm, which shows how it has been managed during the period. Since its foundation, i. e. in the course of 9 years, the Institute has compiled valuable information regarding the organisation of farms, details of income and expenditure of the landowners, etc.

The trend of farm organisation among the different types of farmers is shown in Table I, which gives the percentages of the various crops cultivated for each type and size of farm:

The figures in Table I do not allow a judgment as to the influence of the size of farms on the percentage of the various crops grown. Those of Table II are more interesting.

TABLE I. — *Percentages of the various crops cultivated.*

	Size of farms			
	2-5 ha	5-20 ha	20-100 ha	100 ha
	%	%	%	%
<i>Arable land:</i>				
1) In the beet growing district	91	89	90	93
2) " " cereal	85	81	80	80
3) " " potato	79	79	80	84
4) " " forage	61	77	71	77
<i>Garden:</i>				
1) Do.	5.4	2.1	3.5	2.3
2) Do.	4	1.9	1.7	1.1
3) Do.	2.4	2	1.3	1
4) Do.	1.9	0.9	0.6	0.3
<i>Meadow:</i>				
1) Do.	3	8	5	3
2) Do.	9	16	17	13
3) Do.	17	16	16	13
4) Do.	35	17	22	19
<i>Pasture:</i>				
1) Do.	0.3	0.7	0.8	2.2
2) Do.	1.7	1.6	1	5.9
3) Do.	1.7	2.8	2.3	1.7
4) Do.	2.1	5.9	6.5	4

The area sown with cereals, especially rye and oats, decreases with the increase of the root-growing areas (especially those of the sugar-beet).

TABLE II. — *Percentages of the various crops cultivated.*

Crops cultivated	Size of farms			
	2-5 ha	5-20 ha	20-100 ha	100 ha
	%	%	%	%
Cereals and pulse	64	65	59	57
Root crops	17	15	20	23
Kitchen-garden crops	1	1	1.4	1.4
Forage crops	18	19	20	19
	100	100	100	100

The part of the sugar-beet growing area which is under intensive cultivation increases surprisingly in comparison with the part under potatoes. In this district, potatoes form 50 % of the root crop in the group of farms of 2-5 ha, 36 % in those of 5-20 ha, 15 % in those of 20 to 100 ha, and 9 % in those of over 100 ha. In large holdings, the area of

TABLE III. — *Percentages of cereals and roots taken separately.*

Cereals	2.5 ha	5.20 ha	20-100 ha	100 ha.
	%	%	%	%
Wheat.	14	18	20	27
Rye.	41	35	31	23
Barley.	14	16	22	28
Oats and pulse.	31	31	27	22
	100	100	100	100

Root crops	2.5 ha	5.20 ha	20-100 ha	100 ha
	%	%	%	%
Potatoes.	74	66	44	40
Sugar beet.	20	22	48	60
Mongers and legumes.	6	12	8	—
	100	100	100	100

sugar-beet is about double that in smaller estates; the large holdings also produce the largest quantities of cereals (wheat and barley) for the market as shown in Table IV.

It will be seen that the largest farms grow smaller quantities of cereals and larger forage crops.

TABLE IV. — *Production of cereals and pulse.*

	2.5 ha	5.20 ha	20-100 ha	100 ha
	%	%	%	%
Wheat	26	26	32	42
Rye	35	29	21	13
Barley	22	27	35	38
Oats and pulse	17	18	12	7
	100	100	100	100

TABLE V. — *Subdivision of crops
in the district of intensive cultivation of cereals.*

	2.5 ha	5.20 ha	20-100 ha	100 ha
	%	%	%	%
Cereals and pulse	68	70	66	65
Root crops.	15	13	14	12
Kitchen garden crops.	0.8	0.1	1.1	0.9
Forage crops	16	17	19	22
	100	100	100	100

In the 3rd district, where potatoes are chiefly grown, with the increasing size of farms, the area under cereals decreases and that under forage crops increases; in the large holdings the area under root crops also increases.

TABLE VI. — *Subdivision of crops cultivated in the district where the potato crop is predominant.*

	2.5 ha	5-20 ha	20-100 ha	100 ha.
	%	%	%	%
Cereals and pulse	65	62	59	57
Root crops	16	16	16	20
Kitchen-garden crops	0.9	0.5	1.7	0.8
Forage crops	18	21	23	22
	100	100	100	100

The characteristics of the 4th district, where forage crops are chiefly grown, are shown in Table VII:

TABLE VII. — *Subdivision of crops cultivated in the district where forage crops predominate.*

	2.5 ha	5-20 ha	20-100 ha	100 ha.
	%	%	%	%
Cereals and pulse	57	67	71	69
Root crops	11	12	8	6
Kitchen-garden crops	5.6	1.3	0.8	0
Forage crops	26	20	20	25
	100	100	100	100

It will be seen therefore that on the largest estates the area under cereals increases considerably, while that under root crops and legumes decreases.

The author has also studied the influence of the size of farms on the number of draught and other animals. By estimating the work of oxen and cows on the same scale as the work of horses, using the coefficient 2 horses = 3 oxen = 5 cows, the data set out in Table VIII are obtained.

It will be seen that the need of draught-animals decreases with the increased size of farms and that large holdings make a greater profit from the work of draught-animals than small. Draught animals reduce the stores of forage which could be utilised in dairy-farming, meat production, etc., by other kinds of cattle.

Hence the table shows that the number of cattle decreases with the increased area of farms, and that this is especially the case with milch-cows and young cattle; the medium-sized farms are engaged chiefly in the rearing of young cattle.

TABLE VIII. — *Number of draught animals used on 100 ha of arable land.*

	Farms of 2 to 5 ha		Farms of 5 to 20 ha		Farms of 20 to 100 ha		Farms of more than 100 ha	
	Number of head	Work reduced to horse power	Number of head	Work reduced to horse power	Number of head	Work reduced to horse power	Number of head	Work reduced to horse power
Horses . .	2	2	9.4	9.4	9.8	9.8	4	4
Oxen . . .	4.2	2.8	8	5.3	8.8	5.8	12.6	8.4
Cows . . .	60	24	13.6	5.4	—	—	—	—
Total . .	—	28.8	—	20.1	—	15.6	—	12.4

TABLE IX. — *Live weight in kilograms of horned cattle not utilisable for work. Average per hectare of arable land.*

	2-5 ha	5-20 ha	20-100 ha	100 ha
	kg.	kg.	kg.	kg.
1st district	449	304	225	123
2nd district	458	294	209	153
3rd district	402	264	217	183
4th district	572	272	236	153
Average	446	285	218	145

TABLE X. — *Live weight in kilograms of cattle per hectare of arable land.*

	2-5 ha	5-20 ha	20-100 ha	100 ha
	kg.	kg.	kg.	kg.
Young cattle	109	88	67	32
Fat cattle	—	—	24	40
Cows	287	164	109	67
Total	396	252	200	139

TABLE XI. — *Live weight in kilograms of swine per hectare of arable land.*

	2-5 ha	5-20 ha	20-100 ha	100 ha
	kg.	kg.	kg.	kg.
1st district	52	30	8	0.4
2nd district	41	27	12	2.4
3rd district	25	20	15	3
4th district	14	13	17	4
Average	37	24	12	1.8

Thus the larger the farm, the smaller the number of swine.

As for sheep and goats, it has been proved that sheep have a relative importance on medium-sized farms only and that goats are not found on large holdings.

TABLE XII. — *Live weight in kilograms of sheep and goats per hectare of arable land.*

	2-5 ha	5-20 ha	20-100 ha	100 ha
	kg.	kg.	kg.	kg.
sheep	—	1.1	3.3	2.9
goats	2.7	1.1	0.1	—

Poultry also decrease with increased area of farms as is seen in Table XIII.

TABLE XIII. — *Live weight in kilograms of poultry per hectare of arable land.*

	2-5 ha	5-20 ha	20-100 ha	100 ha
	kg.	kg.	kg.	kg.
Fowls	5.6	3.5	1.8	0.2
Other kinds	4.1	3	1.3	0.1
Total	9.7	6.5	3.1	0.3

It is certain that these proportions between the different classes of domestic animals have an influence on the utilisation of fertilisers and forage, and consequently on vegetable and animal production.

C, A. B.

⁴⁸⁶ — Evaluation of the Risk in Agricultural Enterprises and Assurance of Crops against Adverse Weather Conditions in the United States of America. — See No. 370 of this Review.

⁴⁸⁷ — Cost of Rice Production in the Philippines. — See No. 409 of this Review.

⁴⁸⁸ — Notes on Coffee Growing in Brazil. — See No. 476 of this Review.

⁴⁸⁹ — Cost of Colt Breeding up to three Years in the United States. — See No. 452 of this Review.

490 - **Cost of Milk Production in some of the States of North America** (1). — I. COMBES and BAIN, J. B., A Study of the Factors involved in producing Milk in North Carolina, in *North Carolina Department of Agriculture Bulletin*, vol 41, No. 5, pp. 30, figs. 2 Raleigh, 1920. — II. BAIN J. B., and POSSON R. J., Requirements and Cost of producing Market Milk in Northwestern Indiana, in *United States Department of Agriculture, Bulletin* No. 858, pp. 31 figs. 8 Washington, 1920. — III. BAIN J. B., and BRAUN G. E., Unit Requirement for Producing Milk in Western Washington, *ib. Bulletin* No. 919, pp. 19, 1920. — IV. BAIN J. B., and POSSON R. J., Unit Requirements for producing Market Milk in Vermont, *ib. Bulletin*, No. 923, pp. 18 tabl. 12, fig. 2, 1921. — V. BAIN J. B., BRAUN G. and WOOD W. D., Unit Requirements for producing Market Milk in Southeastern Louisiana, *ib. Bulletin* No. 955, 1921.

I. — A study of the factors involved in the cost of producing milk for direct consumption in the small towns of the counties of Guilford and Forsyth. This study has been undertaken by the experimental agricultural station of North Carolina, in collaboration with the Dairy Division of the United States Department of Agriculture. The enquiry was begun in August, 1915, and lasted 2 years. During the first year, 13 farms were visited monthly, and in the second, 14; the annual production and the factors involved in the cost of production from 557 cows were registered during this period. The average production per cow was 2223 kg. of milk for the 1st year and 2233 kg. for the 2nd. The cost of forage and pasture was 54.8 % of the total cost of the milk production; wages amounted to 28.6 % and sundry expenses (including litter) to 16.6 %. The total cost of production does not include the farmer's remuneration; and this applies also to the 4 following items.

In winter, 50.3 %, and in summer, 46.7 %, of the labour employed on the farm was devoted to milk production; the rest was employed in the refrigerating, bottling and transport of the milk to the consumer. About 18 % of the work was done by women and children, both in winter and in summer.

II. — The Agricultural Extension Service of the Purdue University, in collaboration with the Dairy Division, ascertained the cost of producing milk intended for the Chicago market, for a period of 2 years, beginning the 15th August, 1915, in the county of Porter (Indiana).

In 1915-1916 this Service registered the yield of 334 cows belonging to 16 herds; the average yield was 3119 kg. per head per year. The following year the yield of 404 cows from 21 herds was registered; the result being an average of 3169 kg. of milk per head, per year. The average percentage of fatty matter was 3.7. About the same proportion of cows were not in milk (12-13 %) both in summer and in winter. Births were almost equally distributed over the summer and winter seasons, being 87 per year per 100 cows.

(1) These works form part of a series of studies, all on the same plan for typical districts of several of the States of North America. The most important results of the first were taken from another source and summarised in *R. July* 1921, No. 759: the article analysed contains other interesting data, which are completed by those of the above-mentioned summary. — See also *R. Jan.* 1920, No. 115. (Ed.)

In the annual average the total cost of milk production was distributed as follows: forage 49.4 %; pasture 8.2 %; labour 19.5 %; sundry expenses 21.6 %; depreciation of cows 1.3 %. The calves were credited with 6.8 % of the total cost of the milk production as increased by the depreciation of the cows, and manure with 15.5 %. In winter, 80 % of the labour was employed in milk-production, and in summer, 75.5 %; the rest was used in handling and transport. Women and children performed 15 % of the total labour in winter and more than 19 % in summer.

III. — A study of the cost of milk production and the factors involved in the county of Skagit, about 70 miles north of Seattle (Washington State).

In the 1st year, the enquiry began in August, 1917, and covered 17 herds. In the 2nd year, it began in January 1919, and covered 18 herds. Each herd contained an average of 31.3 cows in 1917-1918 and 36 cows in 1919. In the general average for the 2 years, there was a yield of 3598 kg. of milk, with 3.66 % of fatty matter, per head per year. The majority of the cows were of the Holstein breed. Almost all the milk was sold to the condensing establishments, to which it was transported in motor lorries.

In winter, 115 kg. of manure per 100 kg. of milk produced were taken up in the stable; during the summer, when the cows were pastured during the day 13 kg. only per 100 kg. of milk were obtained; 3 % of the cows did not calve during the year; 55 % calved during the winter season and 42 % during the summer. The total expenditure (including depreciation of the cows) was distributed as follows: forage and litter 43.9 %; pasture 12.5 %; labour 23.5 %; sundry expenses 17.6 %. The depreciation of the herd was estimated at 2.5 % of the total expenses, and 4 % of the total value of the head of cattle.

Paid labour (chiefly that of professional milkers) was employed for 12 % of the work in winter and 59.2 % in summer. Women and children performed 10.2 % of the winter work and 13.8 % of the summer work.

For the keep of a bull for 1 year, 286 kg. of concentrated food; 707 kg. of dry forage; 1392 kg. of fresh forage; 20 kg. of litter; 24 hours of labour, plus pasture and sundry items (buildings, implements, taxes, interest on capital invested in stock, veterinary expenses, rugs, disinfectants, etc.), were required.

IV. — A study on the cost of milk production in the county of Addison (Vermont) made in 1917-1918. The data were taken for the 1st year from 17 herds, containing on an average 26.1 cows, and for the 2nd year from 18 herds, containing an average of 22.4 cows. The cows were chiefly of the Holstein breed; the average annual yield of milk was 382 kg. per head. The milk was conveyed to the central collecting stations, whence it was sent to New York for direct consumption. 41 quintals of manure per cow were taken up from the stable in winter, and 7 in summer; 15 % of the cows did not calve during the year; 27 % calved

during the period from 1st May to 31st October and 58 % during the rest of the year; the majority calved in the spring.

Forage and litter accounted for 49.4 % of the total cost of production (including the depreciation of the cows); pasture 5.5 %; labour 21.8 %, and other expenses 20.7 %. The depreciation of the herd was 3.4 % of the total cost. Manure was set off against 17.7 % of the total expenses, and calves against 5.5 %.

During the winter, 41.7 % of the work was carried out by the owners; 47 % was paid labour; and 11.3 % was done by women and children. In summer the corresponding percentages were 39.1; 42.4; 18.5. In winter, 79.9 % of the work consisted in production, properly so called, as distinct from handling and transport; in summer, 77.6 %.

For the annual maintenance of a bull, 152 kg. of concentrated food; 3044 kg. of dry forage; 1087 kg. of fresh forage; 122 kg. of litter and 37.7 hours of human labour plus the cost of pasture and sundry items, were required.

V. — A study of the factors involved in the cost of milk production in the parish of Tangipahoa (Louisiana) during the 2 years beginning with March, 1918. The data were taken from 14 farms during the whole period of 2 years, and from 8 others for 1 year; they amounted to 892.6 years of production or lactation, yielding, on general average, 1409 kg. of milk, which is sent to New Orleans for direct consumption. The Table given below shows the averages for the 2 years under consideration.

Sundry expenses and quantities of food and work required for milk-production in the parish of Tangipahoa, Louisiana.

	Concentrated food purchased	Grain produced on the farm	Leguminous hay	Other hay	Straw and stalks	Pressed green and other fodders	Manual labour	Horse labour	Litter	Pasture	Sundry expenses (c)
	kg.	kg.	kg.	kg.	kg.	kg.	hours	hours	kg.	dollars	dollars
<i>Per cow:</i>											
From Oct. to March	420	10	35	91	84	465	75.3	11.6	1.8	2.03	13.0
From April to Sept.	426	2	4	4	8	66	82.2	12.1	—	3.55	11.5
For the whole year	846	12	39	95	92	531	164.5	23.7	1.8	5.58	24.7
<i>Per 100 kg. of milk:</i>											
From Oct. to March	70.8	1.6	9.0	15.2	14.1	78.4	11.0	2.0	0.3	0.344	2.2
From April to Sept.	50.2	0.3	0.5	0.5	0.9	8.1	11.0	1.5	—	0.453	1.4

(1) Variations in the inventory value not included.

7820 kg. of manure per cow were taken up in winter and 626 kg. in summer. About 43 % of the cows calved in winter and 42 % in summer.

The forage and litter represented altogether 49.3 % of the total cost of production (including the depreciation of the cows); pasture represent-

ed 4.1 %; labour 24.2 %; other expenses 4.2 %. Manure was set off against 5.5 % of the total cost of production, and calves against 1.7 % (there having been little demand for calves on the market, this credit is rather high).

During the winter, 33.1 % of the work was done by the owners; 41.9 % was paid labour; 25 % was carried out by women and children. During the summer the corresponding percentages were: 28.2; 42.7; 29.1.

For the annual maintenance of a bull, 544 kg. of concentrated food; 353 kg. of dry forage; 511 kg. of fresh forage; 0.9 kg. of litter; 33.6 hours of manual labour, besides pasture and sundry items, were required.

F. D.

AGRICULTURAL INDUSTRIES

491 - **Modern Processes of Wine-Making Technique.** — SANSENO F. A., in *Rivista di Ampelografia*, year II, No. 10, pp. 147-152. Leghorn, October 1, 1921.

The report made to the Brescia National Congress of Wine-Growing (Italy), September 5-6-7, 1921.

WINE-MAKING WITH SULPHUR DIOXIDE (1). — Until quite recently, sulphur dioxide was used only in cellars for the preservation of wine that had already been made, except in the case of sweet wines. It is now, however, employed in wine-making, 10-20 gm. of potassium bisulphite being added per quintal of grapes in temperate climates at the moment of pressing, and as much as 30 gm. in hot climates when the alcoholic fermentation has reached its maximum.

This insures the action of good quality alcoholic ferments and the scent and flavour of the wine is improved; it is more highly coloured, if red grapes are used, and of a finer straw-colour if white ones are employed; in both cases the wine is clearer and keeps better. A great part of the sulphur-dioxide introduced is eliminated during the violent fermentation and hence no bad effects are produced.

The introduction of sulphur dioxide is specially advantageous when the grapes are of poor quality; it should not be used for good grapes grown on the slopes, especially if the wine is to be matured as maturation is hindered by its presence.

In hot climates the addition of sulphur dioxide induces complete fermentation, and replaces plastering, as practised in Sicily, and correction with tartaric acid as is customary in Apulia.

The author gives an account of research in the use of sulphur dioxide in wine-making, and refers to the works of P. CZEPPIL (1888). Head of the Wine Vaults of the "R. Scuola Enologica of Catania", of Prof. U. RICCIARDELLI (of the "R. Cantina sperimentale of Riposto"), of MENSIO and PARIS in Italy, and of MARTINAND, ROOS, SEMICHON, ASTRUC, and VENTRE, in France.

(1) See R. Nov. 1917, No. 1061. (Ed.)

INDUSTRIES
DEPENDENT
UPON
VEGETABLE
PRODUCTS

The introduction of sulphur dioxide facilitates the use of selected ferments.

Certain "associated" products are found on the market, such as JACQUEMIN bisulphite, and HUBERT sulphophosphate; these are mixtures of two substances, one of which liberates sulphur dioxide, while the other provides food-material, such as ammonium phosphate, for the alcoholic ferments.

The addition of sulphur dioxide at the time of manufacture increases the keeping capacity of the wines but does not protect them against "la fleur", or prevent their turning acid in the barrel when sold retail; the only remedy in both these cases is the introduction of carbon dioxide.

UNFERMENTED GRAPE PRODUCTS. — Fermentation is entirely prevented by adding to unfermented must 70 gm. of sulphur dioxide per hectolitre. If such must is poured into a concentrating apparatus, and distilled in a vacuum, the sulphur dioxide is first removed, and then the water, the resulting product being a concentrated must that can be used for many purposes.

The author mentions the BARBET apparatus which obviates the need of large plants, and the EUDO MONTI apparatus (1) in which concentration is obtained by lowering the temperature.

THE RAPID PRODUCTION OF SPARKLING AND THE QUICK MATURATION OF OTHER WINES (2). — The wine is pasteurised if necessary, or else heated to the best temperature for insuring rapid fermentation. The required amount of sugar and of selected ferments are added, and the wine is allowed to flow into large, closed vessels of enamelled iron. After ten days, the pressure of 6 atmospheres is reached, and then the wine passes automatically, and without any loss of carbon dioxide, into other enamelled or silver-plated receptacles. By means of the refrigerator it is cooled down to some degrees below zero to keep it as clear as possible. Sparkling wine is filtered without loss of gas, and when quite clear, passes into another vessel and thence into bottles, still retaining its gas. In Italy there are some CHARMAT plants already at work. This method can also be used in the preparation of sparkling Muscat which is more difficult to make than champagne.

The CHARMAT process for maturing wines is based on the use of high and low temperatures. The wine is pasteurised in an anotherm, under pressure and in the presence of air, in order to allow the bouquet to develop; it is then cooled for a time at some degrees below zero and finally filtered and bottled.

MONTI devised a rapid maturing process which consists in passing a current of air through wine cooled at 2-4 degrees below zero, but this method does not suit all kinds and cannot for instance be employed in the case of Marsala, as it destroys the characteristic bouquet.

(1) See R. 1914, No. 946; R. 1917, No. 857; R. 1920, Nos. 249 and 509. (Ed.)

(2) See R. Oct., 1921, No. 1042; R. July 1921, No. 756. (Ed.)

The author is of opinion, that the adoption of the CHARMAT and MONTE processes will greatly stimulated the progress of the already extensive Italian wine-industry.

F. D.

492 - **Experiments in Fermenting Kaki Fruits.** — MANZONI L. (R. Scuola di Viticoltura ed Enologia, Conegliano), in *Le Stazioni sperimentali agrarie italiane*, Vol. LIV, Parts 7-10, pp. 284-288. Modena, 1921.

The kaki has the advantage of being very hardy; it is not an exacting plant and produces a heavy, regular crop. One hectare can bear 350 trees, each yielding 1 quintal of fruit. As the fruit can only be directly consumed to a limited extent, and when perfectly ripe is very rich in sugar, the author tried to find out whether it could be made useful by fermentation.

Kaki fruits gave on analysis 16 % of reducing sugar but only 0.4 per 1000 total acidity, hence the author in order to obtain satisfactory fermentation made the following additions:

1) bi-tartrate of potassium 5.5 per 1000 + tartaric acid 1 per 1000 + citric acid 1 per 1000. In this manner, a total acidity of 4.4 per 1000 was obtained expressed as tartaric acid.

2) one quart of sterilised white grape must (with 22 % of sugar and 12 per 1000 acidity) + bi-tartrate of potassium 5 per 1000 + tartaric acid 1 per 1000 thus making a total acidity of 3 per 1000 expressed as tartaric acid. In both cases, the selected wine-making ferments were added and fermentation took place at 22° C.

The process began with a clearly marked separation of the liquid part and the spongy layer above it. On the fourth day, while fermentation was still active, the mixture was passed through a cloth, 74 % of liquid being thus obtained; a yield of 80 % of must could therefore be expected if industrial presses were employed. The must was then allowed to ferment slowly and was cleared with tannin and gelatine.

The results of the analyses made when fermentation was complete were as follows:

1) Wine from kaki fruits alone: alcohol 8.9 %; dry extract 22.42 per 1000; acidity 4.7 per 1000; ash 2.64 per 1000.

2) Kaki wine with $\frac{1}{4}$ grape must: alcohol 9.5 %; acidity 4.12 per 1000; slightly sweet.

The wine remained sound and clear. When tasted, the first was clear and of a pale straw colour tending to greenish. It had an alcoholic scent mixed with an almost aromatic fruit bouquet, a slightly acid, dry, rather bitter taste which was flat and not vinous. The second, made with the addition of grape must was very clear, of a light golden-yellow colour, and with peculiar scent of flowers. It had a pleasant sweetish, slightly acid flavour which was stronger and cleaner than that of the wine made from kaki fruit alone. It had in fact the taste of a good cider without any of its disagreeable qualities.

"Wine" made from kaki fruit without any admixture of grape must yielded a good vinegar with 4.89 % total acidity. A 45° brandy was

obtained from the "wine" by distillation with a scent resembling that of an ordinary pomace brandy and tasting like cider brandy.

These results show that it is technically possible to make good cider by the addition of grapes or other fruits to kakis, or to obtain a satisfactory product by the distillation of "wine" made from kaki fruits alone. It is an interesting fact that the kaki tree is much less difficult to grow than the cider apple-tree and yields a larger crop per acre. R. D.

493 - **The Raw Materials used in the Italian Alcohol Industry.** — Sessa I., in *Giornale di chimica industriale ed applicata*, Year III, No. 12, pp. 563-564. Milan, December 1921.

The following Table gives the number of *hectanhydres* of the various kinds of alcohol made in Italy from 1906-1907 to 1919-20 from different raw materials. The figures refer in each case to the fiscal year dating from July 1 to June 30, and have been taken from the statistics of the taxes on alcohol manufacture published by the Italian Ministry of Finance.

An examination of this Table brings out the dominant feature in the Italian alcohol industry, viz., the great variation from one year to another in the raw material used which admits of a very simple explanation. Alcohol can be manufactured from various matter or from substances containing starch or sugar; there is thus a wide field of selection, and cereals, beer or wine are employed according to the condition of the markets. The raw materials for the manufacture of alcohol may be divided into 2 categories

Essential materials, viz., those that can be used for no other purpose such as spoiled cereals, pomace of various kinds, wines that have gone sour, surplus wine in years of over production, molasses etc.

Optional materials viz. those only occasionally used for making alcohol when the conditions of the market permit, such as sound cereals, beet fruits etc.

Naturally it is the former class that first supply the alcohol market and sometimes even over-stock it. The production of molasses alcohol keeps pace with the development of the sugar industry; immense quantities of wine alcohol are available in years of superfluous wine-production such as 1907-1908-1909 while the amount of pomace alcohol remains constant and is in correlation with the vintage season.

The consumption of alcohol in Italy during the pre-War years reached a maximum of 350 000 *hectanhydres*.

The optional materials are used to a limited extent only, according to cost, thus cereal and beetroot alcohols are employed alternatively to make up the annual deficit.

Under the head of various substances are included fruit in general (dried fig, dates, carobs etc.). They are not much used as a rule, but were sent to the distilleries in considerable quantities during the War and in the years immediately following, when the alcohol market underwent a serious crisis owing to the absolute dearth of raw materials and the abnormal stocks of these fruits in hand due to the prohibition of all export.

Alcohol Production in Italy, in Hectanhydres.

Raw materials	1906-07	1907-08	1908-09	1909-10	1910-11	1911-12	1912-13
Cereals	81 660	57 539	32 411	12 527	64 934	59 865	112 143
Molasses	98 841	85 739	119 990	106 866	158 236	130 742	147 801
Beetroots	13 785	11 598	13 468	8 554	8 858	9 653	22 941
Dried grapes	5 985	83 271	3 076	1 949	26	148	—
Pomace	72 162	106 922	128 833	100 341	46 698	57 847	62 340
Wine	2 912	115 869	501 314	188 261	16 446	1 251	2 941
Various substances	2 089	2 439	1 445	423	1 479	1 126	964
Totals . . .	211 434	463 377	800 537	418 921	296 667	280 632	349 131

Raw materials	1913-14	1914-15	1915-16	1916-17	1917-18	1918-19	1919-20
Cereals	56 137	12 999	45 007	33 202	8 678	11 374	79 398
Molasses	185 530	188 070	167 737	139 241	117 063	167 049	18 359
Beetroots	31 075	13 214	17 870	103 279	116 105	4 675	10 262
Dried grapes	—	—	—	—	—	—	—
Pomace	82 061	72 622	24 051	34 245	49 578	40 175	36 072
Wine	10 281	10 848	859	335	3 418	8 415	2 243
Various substances	499	209	6 992	4 692	5 069	6 809	15 635
Totals . . .	371 582	297 962	262 516	314 994	299 211	238 497	331 969

lation. Under ordinary circumstances fruit and carobs can be more advantageously used, and they are only sent to the distillery when the price of alcohol is very high *e. g.* 900 lire per *hectanhydre*, exclusive of tax.

With free competition, the price of alcohol is fixed by the cost of the best raw material available in unlimited quantities. To avoid over-production, the price of alcohol made from the first class of materials must be regulated by this price and always kept below it. Normally the price of alcohol depends upon the price of maize, which can be obtained in great quantities and is highly estimated throughout the world. Sometimes, however, the price is governed by the cost of beetroots, but to a less extent, the beet being a seasonal product.

G. A. B.

494 - Experimentation in Milling and Baking of "Adlay" (*Coix Lacryma Jobi* var. *mayuen*). — See No. 412 of this Review.

495 - Oil from the Pips of French Grapes. — DE FAYARD, J., in *Revue de Viticulture* Year 28, Vol. V, No. 1635, pp. 486-487. Paris, December 29, 1921.

From the various analyses of grape pips made by the author at Charente, the following oil-content percentages were obtained: Folle Blanche 10 to 12.50 — Saint Emilion 9 to 11.3 — Colombard 10.5 to 12. The amount of oil present would seem to be correlated with the ripeness of the grapes.

The physical and chemical constants of the 2 samples of oil prepared by the author by extraction with carbon tetrachloride were as follows:

	I	II
Density at + 15° C.	0.933	0.926
Solidification point	— 11	— 12
Saponification index.	182	178
MAUMENÉ test	56	53
Iodine index	96	94
REICHERT-MEISSL index	0.46	0.39
HEXNER index	94.5	92.6

F. P.

496 - The Utilisation of the Residues of Oil Extraction from Olives (1), — D. MANJARRÉS, R., in *La Revista Vinícola y de Agricultura*, XLI, No. 4, pp. 39-40. Saragossa, February 16, 1922.

More than 2 years ago, the author in collaboration with Count DE CAS CHAVES, Director of the Regional Mineralogical Museum of Cordova started research work upon the systematic utilisation of the residue from olive-oil factories. When it is realised that the oil industry in Spain produces an average of 200 000 tons of exhausted pomace, and that owing to the scarcity of forests, the products of wood distillation find a ready sale, it can readily be understood that the distillation of this residue may be very profitable.

Distillation can be carried out in closed vessels differing considerably from those usually employed, for the pomace can be closely piled so as to leave no space for the free escape of the volatile substances. According to the authors' experiments, from one ton of pomace may be obtained 200 kg. of charcoal in practically powder form and 160 cub. m. of complex and very combustible gases; the condensed liquids consist of acetic acid, alcohol and ammonia. The acetic acid is separated with milk of lime, as in the distillation of wood. For the separation of the alcohol from the ammonia, superphosphate of lime must be used; by this means a phospho-ammoniacal fertiliser is obtained and the alcohol is liberated.

One ton of pomace gives: 40 kg. acetic acid, 80 kg. of tar and 17 litre of methyl alcohol. The charcoal and gases supply fuel for the distilling apparatus. In large factories briquettes can also be made of the tar and charcoal dust. The ashes form a fertiliser for the olive-trees.

The blackish, turbid liquid deposited at the bottom of the vessel under oil-presses is called *eaux d'enfer*, and is of very variable composition according to the oil-factory. The amount produced in Andalusia may be estimated at 300 000 tons.

From one ton may be obtained: 15 litres of rectified ethyl alcohol 3 kg. ammonium sulphate and a small, variable quantity of an innocuous red, colouring substance that can be used for the coloration of syrups, liqueurs etc. The *eaux d'enfer* must be subjected at once to alcohol

(1) See R. Dec. 1915, No. 1259; April 1916, No. 445. (Ed.)

fermentation; from the distillation residue other substances can be obtained by the ordinary processes.

On evaporation the resulting liquid, deposits potassic salts, and if the semi-fluid residue is subjected to distillation, charcoal and gases are obtained, but it should be noted, that during the process the residue increases in volume, and the vessels used must therefore be of a special shape.

The process is remunerative provided that: 1) large amounts of material are used; 2) the residues are utilised for fuel; 3) all the escaping heat is turned to account; 3) economical evaporators are employed.

P. C.

97 - **Economic Value of Sunflower Oil: Tests made in Great Britain.** — See No. 431 of this Review.

98 - **Variations in the Percentage of Fat in Successive Samples of Cows Milk** (1). — RAGSDALE A. C., BRODY, S. and TURNER, C. W., in *Journal of Dairy Science*, Vol. X, No. 5, pp. 448-450. Baltimore, September 1921.

INDUSTRIES
DEPENDENT
UPON ANIMAL
PRODUCTS

The fact that successive samples of milk drawn from a cow gradually increase in fat content, has long been known and was formerly explained by supposing that the fat being lighter rose to the top of the milk cistern and ducts.

This gravity theory was however discarded as a result of the observations of HEDENHAIN, who found that the difference in the volume of the udder before and after the evacuation of milk is much below the volume of milk given by a cow during one milking, and consequently inferred that a large part of the milk is secreted during the process of milking. The authors describe their own experience which may contribute to an explanation of the phenomenon. The right front quarter of a Jersey cow producing about 20 pounds of milk per day was milked under the following conditions:

Amount of Fat in Successive Fractions of Milk.

Sample No.	Cow			Cylinder	
	Upon coming into barn	After standing 2 hours	Standing 2 hours and manipulation	After standing 1 ½ hours	After standing 3 hours
1	3.1 %	1.4 %	6.3 %	4.4 %	1.6 %
2	3.2	1.5	6.1	5.4	2.7
3	4.7	1.9	6.4	5.7	3.6
4	5.4	3.0	6.5	5.8	4.2
5	5.9	3.4	6.5	5.9	4.9
6	6.6	4.1	6.8	6.0	5.4
7	6.9	4.8	7.2	6.0	5.9
8	6.5	7.8	7.5	6.3	6.8
9	6.8	11.0 (about)	8.2	6.7	12.0

(1) See R. June 1920, No. 670. (Ed.)

1) immediately on coming into the barn from the pasture; 2) after standing quietly in the barn for two hours; 3) after standing in the barn for two hours followed by a thorough massaging and manipulation of the udder for a few minutes for the purpose of "mixing" the milk within, if possible. The milk in each case was milked into a 100 cc. cylinder and fat determined in each of the 100 cc. fractions. For comparison determinations were made on the variations of fat in successive 100 cc. of milk drawn from a 900 cc. cylinder of the usual dimensions after standing respectively for 1 1/2 and 3 hours. The results given in the Table show that, within given limits, the longer the cow stands quietly the greater the variation in the fat content of the successive fractions of the milk. The curves of variation in the cylinder and udder are strikingly similar.

F. D.

499 - **Brown Glass Milk Bottles and their Use in preventing Milk from Acquiring abnormal Flavour and Odours due to the Action of Light.** — HAMMER, B. W. and CERDES, W. A., in *Advance Sheet of Research Bulletin 64, Iowa Agricultural College*, summarised in *The Creamery and Milk Plant Monthly*, Vol. X, No. 8, pp. 23-24, Chicago, 1921.

The authors have made a comparative study of the effect produced upon the colour, flavour and bacterial content of milk by placing it in white and in coloured bottles respectively. The results proved that sunlight produces abnormal flavours in milk and cream, whence the necessity of keeping bottles of milk, even in winter, in a special covered chest or under a blanket.

Though brown milk-bottles prevent these changes, their use cannot be advocated, because they make it difficult to see the sediment, or the cream line, thus preventing whole milk being distinguished from milk that has been more or less skimmed. Milk kept in brown bottles has also a higher bacterial content than milk in ordinary bottles, which is in part due to the higher temperature of the brown bottles, and also to the fact that light has a decided influence in keeping down the number of bacteria in white bottles. In fact if part of the same milking is exposed to sunlight in ordinary bottles and the rest kept in the dark in similar bottles, it will be found that the bacterial content is lower in the exposed milk, although the temperature is higher.

From the general results of their observations, the authors have drawn the following conclusions:

Sunlight has a pronounced influence on the flavour of milk and cream with sufficient exposure a definite tallowy flavour was produced, and with less exposure a distinct sour flavour developed.

Sunlight is observed to produce an abnormal flavour, sometimes tallowy and sometimes otherwise, in other dairy products, such as ice cream, evaporated milk, skim milk and starters. When milk or cream has acquired a tallowy flavour from exposure to light, it is communicated to the butter which does not lose it by keeping.

When there was an increase in acidity in milk exposed in ordinary bottles and brown, the increase was generally greater in the brown bottles.

The colour of milk exposed to sunlight does not alter nearly as much as in brown as in colourless bottles, in which the milk after a time shews a chalky dead-white appearance and produces butter of much lighter colour. Light has a greater influence on a milk low in fat content than on a milk with a high fat content.

Exposure to air had evidently some influence on the development of a tallow flavour.

The tallowy flavour in milk exposed to sunlight in white bottles apparently decreased somewhat as a result of storage at low temperature.

F. D.

300 - Influence of Foreign Matter upon the Number of Bacteria in Milk. — HARDING, H. A., PRUCHA, M. J., KOHMAN, E. P., WEETER, H. M., and CHAMBERS, W. H., in *Journal of Dairy Science*, Vol. IV, No. 5, pp. 430-447. Baltimore, September 1921.

It used to be thought that the absence of foreign matter or dirt had a great influence upon the bacterial count of milk, but the results of recent research tend to show that the cleanliness of milk in this respect is of much less importance than has been supposed. The existing divergence of opinion however encouraged the authors to make an experimental study of the question at Urbana, the Illinois Agricultural Experiment Station.

The results of their investigations have shown that :

Practically all the dirt entering the milk at a farm is introduced during the operation of milking.

The use of a small-topped milk-pail materially reduces (from 20 to 40 %) the amount of impure matter that finds its way into the milk.

The weight of the impurities entering the milk during the milking process is surprisingly small. Even when the cows were extremely dirty and milked into an open-topped pail, the dirt in the unstrained milk amounted to only about 10 mgm. per quart. When the conditions were comparable to those of ordinary dairies and the small-topped pail was used, the dirt in the milk was less than 5 mgm., per quart.

The kinds of impurities which fall into the milk vary with the condition of the coat of the cow. With hand-milking the entrance of some hair and dandruff is practically unavoidable, though the amount may be reduced by regularly brushing the coat of the animal. If flank or udder is soiled with dried manure or other dirt, some may also find its way into the milk.

Thorough straining removes the hair, dandruff, and larger particles which form 75 to 90 % of the visible dirt. Undoubtedly some of the impurities go into solution in the milk, but the amount is so small that the authors did not succeed in measuring or detecting it.

The increase in the bacterial count due to the entrance of dirt into the milk varies widely with the nature of the dirt. Hair and dandruff from clean cows have much less effect than from dirty cows.

On extremely dirty cows there were 1500 million germs per gram of dirt. Under the worst conditions when the dirt in the milk amounted

to 10.8 mgm. per quart, the increase in the number of bacteria was about 17 000 per cubic centimetre. Under similar conditions, except that a small-topped pail was used, which reduced the dirt to 8.1 mgm. per quart the bacterial count due to dirt fell to 13 000 per cubic centimetre.

The use in warm weather of clean utensils which have not been promptly and thoroughly dried results in the immediate increase of the germ count of the milk varying from 30 000 to 1 000 000 per cubic centimetre.

In summer milk drawn in the morning and delivered from the farm to the milk plant has an average bacterial count of at least 50 000 per cubic centimetre. After the first 6 to 10 hours, the growth of the microorganisms begins and their number may rapidly increase.

In view of these facts it is clear that the variations due to dirt which occur in the bacterial count, and may be as large as 17 000 per cubic centimetre, will be less important than other factors at any rate in summer.

When the time interval permits growth, it is impossible to judge, on a basis of bacterial count, the conditions of cleanliness in the production of a given sample of milk.

An examination of milk based on the germ count does not therefore protect the consumer. In order to prevent the sale of milk contaminated by impurities it is necessary: to determine the impurities actually present by measuring the sediment formed, or by filtering the milk through cotton and weighing the filter before and after filtering and drying. By this method the data obtained are a little higher than they are in reality.

F. D.

501 - Type of Lactic Acid produced by Starters and by the Organisms isolated from them. — HAMMER, B. W., in *Advance Sheet of Research Bulletin 56, Iowa Agricultural Experimental Station and the Creamery and Milk Plant Monthly*, Vol. X, Part 8, p. 4. Chicago, 1921.

Recent work has shown that starters are not pure cultures of *Streptococcus lacticus* as is commonly supposed. HAMMER and BAILEY showed that pure cultures of the *Streptococcus* do not produce a volatile acidity at all comparable with that obtained by a good starter and that starters generally contain an associated organism which when grown in combination with *S. lacticus*, yields a volatile acidity essentially the same as that produced by a satisfactory starter. STORCH found that organisms, which he calls *x* bacteria, are present in starters and that these play a part in the production of a good cheese. BOCKHOUT and ORT DE VRIES reported the isolation from starters of organisms that in combination with lactic acid bacteria produce the characteristic aroma.

It can be proved that starters are not pure cultures of *S. lacticus*, by ascertaining the type of lactic acid found in a starter and comparing it with the type produced in milk by pure cultures of *S. lacticus*.

This method was adopted by the author, who also determined the type of lactic acid produced when the associated organisms are combined with *S. lacticus*.

It has been shown by the work of a number of investigators (HEIMANN, SUZUKI, HASTINGS and HART, ORLA JENSEN), that *S. lacticus* only produces dextrogyric lactic acid, at least under the usual conditions of growth.

The author examined a number of starters that had been used in a creamery and found that they did not produce pure dextrogyric acid, but a mixture of active and inactive acids. Starters are thus not pure cultures of *S. lacticus*, and the associated organisms are undoubtedly important in producing a type of non-dextrogyric lactic acid. The results obtained suggest that the associated organisms are able to transform dextrogyric lactic acid into levogyric lactic acid. F. D.

92 - Connection between the Number of the Bacteria in the Milk and the Quality of the Cheese obtained. — HUCKER, G. J. in *New York Agricultural Experiment Station, Geneva, Bulletin No. 486*, 19 pp., 8 figs. Geneva, N. Y., 1923.

This paper is the first of a series of studies on the bacteriology and ripening of cheeses and the connection between this ripening and the bacterial flora of the milk. The data upon which this study is based were collected during the winter of 1920 in a cheese-factory near Philadelphia, where whole milk Cheddar cheeses of the "Young American" type were manufactured. The counts of the bacteria present in the milk were made on samples taken from the milk supplied by 25 members of the cheese factory and on samples taken from the cauldron; in some cases the number of bacteria was estimated from the acidity.

It was found that there is no connection between the bacterial content of the milk and number of marks accredited to ripe cheese, although milk with the maximum of microorganisms (12 to 14 million per cc.), tends to make better cheeses of a constant type, whereas milk with few bacteria produces cheeses of variable quality.

The number of bacteria present in the milk does not appear to have any effect upon the amount of cheese produced.

The character of the species of bacteria in the milk intended for cheese-making is of much greater importance than their number; hence milk intended for the cheese factory should not be judged from the bacteriological standpoint in the same manner as milk to be drunk in its natural condition. F. D.

93 - Chemico-Bacteriological Study of Different Qualities of Silaged Forages (1). — HUNTER, C. A. (Pennsylvania Agricultural Experiment Station), in *Journal of Agricultural Research*, Vol. XX, No. 7, pp. 767-789, diagrams 6, bibliography of 20 works. Washington, 1921.

The object of these researches was the study of the nature of the fermentations arising in a mixture of several silaged forages and thus to make

AGRICULTURAL
PRODUCTS
PRESERVING,
PACKING,
TRANSPORT,
TRADE

(1) For other studies on silaged forages see: R. Jan. 1916, No. 109; R. Feb. 1916, No. 232; R. Feb. 1918, No. 221; R. Jan. 1919, No. 103; R. Feb. 1919, 257; R. July-Pl. 1919, No. 1010; R. July-Aug. 1920, No. 802; R. May 1921, No. 471; R. Sept. 1921, No. 952. [Ed.]

a new contribution to the study of the still much discussed question of the agents which cause the transformations to which such forages are liable. It was originally believed that these changes were due to the enzymes present in the plants, later they were attributed to bacteria, but at the present time some investigators are inclined to think that enzyme and bacterial action both come into play, although they consider the former to be the more important agent. The hydrolysis of plant proteins, which during fermentation accompanies the increase in volatile and non-volatile acids and the formation of ammoniacal nitrogen, seems to be induced first by enzymes and afterwards by microorganisms.

The forage silaged consisted of: 1) vetch + oats; 2) maize; 3) maize + soya. The two latter were compared and the product was analysed from the bacteriological and chemical standpoints at different stages of ensilage.

These analyses showed very little difference in the fermentation processes in the silaged forage, whether vetch and oats, maize alone, or maize and soya. In the forage consisting of maize only, the bacteria of the *bulgaricus* group were more numerous than in the mixed forages.

The analyses also proved that micro-organisms are the chief fermentation agents in forages to be made into silage; enzymes however play a part in the hydrolysis of the proteins with the formation of aminic nitrogen. The production of acids is due to the micro-organisms, while in the formation of ammonia both enzymes and micro-organisms are equally active. Yeasts appear to have little effect on the fermentation of silaged forage, except during the first few days.

F. D.

PLANT DISEASES

GENERAL INFORMATION

04 - Government Enactments in Formosa regulating the Importation and Exportation of Plants. — INTERNATIONAL INSTITUTE OF AGRICULTURE *Textes législatifs de l'année 1921*, No. 30 (1).

1) Edict of April 15, 1921, No. 5 promulgating the law dealing with the importation and exportation of plants. — *Kwampô* (Official Journal), No. 2665, June 20, 1921.

2) Decree of September 10, 1921, No. 142, containing the text of the law controlling the importation and exportation of plants. — *Kwampô*, No. 2753, October 4, 1921.

In the second decree the plants and portions of plants intended both for importation and exportation for which inspection is required are specified. It contains the rules to be observed by any person intending to import or export such plants or portions of plants, as well as the powers conferred upon the officers of the Phytopathological Service; it establishes the conditions under which the importation of injurious diseases and insects etc., may be authorised. Ten forms are appended, *viz.*, request for the inspection of plants or portions of plants to be imported from abroad or from other parts of Japan; request for the inspection of plants or portions of plants to be exported abroad or to other parts of Japan; request for permission to import from abroad or from other parts of Japan, injurious diseases or insects; request for the inspection of injurious diseases or insects to be imported from abroad or from other parts of Japan; request for the inspection of plants or portions of plants imported from abroad (or from other parts of Japan), by means of the ordinary post; label certifying inspection; stamp certifying inspection; certificate of origin for inspection of nursery-garden products; certificate of origin

LEGISLATION
AND
ADMINISTRATION
FOR
PLANT
PROTECTION

(1) The text of the decrees of the Formosa Government, and the texts of other enactments to which reference is made later in this article are to be found reproduced in their entirety in the collection of the *Textes législatifs* published in 1921 in separate volumes by the International Institute of Agriculture.

The object of this collection is to make known immediately the most important legislative measures referring to agriculture that have been enacted in the different countries of the world. These measures, together with all those not contained in the *Textes législatifs*, will afterwards be included, as usual, in the *International Year Book of Agricultural Legislation*, so published by the International Institute of Agriculture. (Ed.)

for nursery-garden products packed with soil; label certifying that inspection has been omitted; stamp certifying that inspection has been omitted.

3) Decree of September 10, 1921, No. 144 fixing the fifteenth day of September 1921 as the date on which the law controlling the importation and exportation of plants comes into force.

Kwampō, No. 2753, October 4, 1921.

4) Decree of September 10, 1921, No. 158 defining the powers of the Plant Inspection Station of the General Government of Formosa. — *Taiwan noji* (Agricultural Review of Formosa), No. 179, October 1, 1921.

On September 15, 1921 a Government Plant Inspection Station under the supervision of the Director General of Production was established in Formosa. This Station is charged with the inspection and control of the exportation and importation of plants as prescribed by the relevant regulations. It will also undertake studies and scientific research work on injurious diseases and insects. The Governor shall have the power to establish Sub-Stations in suitable places, and to endow them with certain of the powers of the Central Station.

5) Official Order of September 10, 1921, No. 13 appointing the post-offices to carry out the provisions of Art. 13 of the regulation relating to the control of the importation and exportation of plants. — *Taiwan noji-hō*, No. 179, October 1, 1921.

The order prescribes that: "the post-offices appointed for this purpose shall — when they have received or accepted for dispatch postal packages containing goods subject to inspection in accordance with the provisions of the regulations governing the control of the importation or exportation of plants — notify the Station of Plant Inspection or one of its Sub-Stations. The inspection of the packages shall be carried out in the presence of the postal official."

6) Official Order of September 10, 1921, No. 13; fixing the amount of duty to be paid pursuant to Art. 4 of the law dealing with the control of the importation and exportation of plants. — *Taiwan noji-hō*, No. 179, October 1, 1921.

According to Art. 4 a fixed fee shall be paid for the inspection of citrus fruits intended for export to Japan.

7) Decree of September 10, 1921, No. 143 fixing the places where the inspection prescribed by the law relating to the control of the importation and exportation of plants shall be carried out.

Kwampō, No. 2753, October 4, 1921.

The full text of the law of March 25, 1914, No. 11, which deals with the control of the importation and exportation of plants is also added for purposes of reference.

G. T.

5 - Decree of April 7, 1921, No. 143, Respecting the Control of *Chrysophlyctis endobiotica* in Czecho-Slovakia. — *Sbirka zákonů a nařízení*, No. 31, April 16, 1921 (Cfr.: *Textes Législatifs*, etc., No. 12).

The importation into the Czecho-Slovakian Republic of potatoes attacked or suspected of being attacked by "canker" (*Chrysophlyctis endobiotica*), as well as their transport through the country are prohibited. All potatoes imported into Czecho-Slovakia or to be conveyed through the country, are subjected as soon as they reach the frontier, to inspection by the special Phytopathological Commissions which have their Headquarters at specially appointed Experiment Stations. The decree defines the duties of these Commissions of which the members are appointed by the Ministry of Agriculture.

All consignments of potatoes from abroad must be provided with a copy of the immunity certificate issued by a State Experiment Station, or by a Public Experiment Station of Phytopathology in the country of export.

Every potato grower or land owner is required to notify immediately any case or suspected case, of "canker" to the recognised Communal authority who will in turn at once forward the notification to the Experimental Station of the zone where the case or suspected case has occurred. The potato grower or land owner is further required, to forward for gratuitous inspection, a sample of the potatoes to the recognised Experiment Station, in order that all necessary measures may be taken. Pending the conclusion of the examination and further instructions, the potatoes may not be removed.

Districts where the presence of "canker" has been reported or suspected, are declared to be "infected districts" and the potatoes growing therein may not for any reason be lifted except by direct order of the Ministry of Agriculture.

Potatoes infected or under suspicion of infection by "canker", cannot be used for "seed".

The Ministry of Agriculture may proceed after indemnifying the owner to the confiscation of the diseased potatoes and may prohibit until further notice the raising of potatoes on infected land or land on which infection is strongly suspected, and in this case, compensation may be granted. Should the grower or holder of the potatoes have omitted to declare the presence of "canker", he is not entitled to any indemnity compensation.

The Experiment Stations that are the Headquarters of the Phytopathological Commissions are responsible for carrying out the measures for controlling the disease.

G. T.

6 - Decree of October 25, 1921, Respecting Insectivorous Birds and Bird-Catching, in Belgium. — *Moniteur belge*, No. 315, November 11, 1921 (Cfr.: *Textes législatifs*, etc., No. 23).

A list of the insectivorous birds that may not, at any season of the year be caught, killed or destroyed, exposed for sale sold, or bought in Belgium, or conveyed through Belgium to other countries.

The decree contains the regulations governing bird-shooting, bird catching, the use of and trade in various birds not included in the above category.

G. T.

507 - Law No. 20 of July 28, 1921, Relating to the Control of the Pink Boll Weevil and of the seed of the Cotton Plant in Egypt. — *Journal Officiel*, No. 70, August 1, 1921 (Cfr.: *Textes législatifs* etc., No. 9).

Every year after the harvest, and at latest previous to the dates that will be fixed annually for each district, or zone, by the Ministry of Agriculture, the roots of the cotton plant, of "til" (*Hibiscus cannabinus*) and of "bamia" (*H. esculentus*), shall be removed from the ground or cut down below the level of the soil, so that they are unable to send out fresh shoots. Within the same space of time all bolls containing seed found lying on the ground ought to be collected and destroyed.

The Ministry of Agriculture has also the power of ordering that all the capsules remaining on the cotton-plants and *Hibiscus* shall be gathered and at once destroyed, even before the dates that are to be fixed annually.

The cotton of each crop must be ginned before the 1st of May subsequent to the harvest.

All the seed of each crop immediately after ginning must be subjected to special disinfection in accordance with the regulations of the Ministry of Agriculture. Without the permission of the Ministry, no cotton seed, cotton waste, residues etc., with the exception of ginned cotton and such seed as has been thoroughly disinfected by the above mentioned process, shall be removed from the premises where the ginning operations are carried out.

G. T.

508 - Plant Quarantine Service in the Philippines. — See No. 360 of this Review.

DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

509 - Sulphate of Iron and Perchloride of Iron in the Treatment of Chlorosis of the Vine (1). — ERICHELLE E., in *La Propaganda Agricola*, Series II, Year XIII No. 1 pp. 206-209. Bari, 1921.

In treating "chlorosis" of the vine with sulphate of iron it is necessary according to the author, to insure that this salt exerts a rather prolonged action on the root system of the host plant. For this reason instead of applying a solution of iron sulphate to the soil around the diseased vine, it is better to use it in the form of powder which should be well mixed with soil and spread round the vine-stock at a distance of 50-60 cm. The soil is then lightly watered for some days which causes the salt to dissolve gradually and provides the roots with a constant supply.

(1) See R. March 1920, No. 366. (Ed.)

a weak solution, which will not become too concentrated. For this treatment 250 to 300 gm. of sulphate of iron are sufficient.

Better experimental results, as regards efficacy, rapidity and economy, were obtained by the author in the treatment of chlorosis with perchloride of iron than with sulphate of iron if very dilute solutions were employed.

The author advises that perchloride of iron be prepared and applied in the following manner.

A 2 % solution is made by adding 10 to 12 gm. of perchloride of iron to 5 or 6 litres of water. This mixture is poured into a circular trench dug round the vine-stock at a distance of from 50 to 60 cm., in order to get as near as possible to the roots and the trench is afterwards filled in with soil.

By the adoption of this method severely infected vines have been permanently cured, whereas others which were treated with sulphate of iron and appeared to have recovered became chlorotic again after some time had elapsed.

G. T.

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS

510 - Reduced Yield of chief Crops, due to Fungoid Diseases, Insects and Animal Pests, in the United States of America. — See No. 379, of this Review.

GENERAL

511 - Insufficient Phosphatic Fertiliser a Factor favourable to the Development of Rice Diseases. — See No. 411 of this Review.

512 - Varieties of Potatoes resistant to *Synchytrium Solani* in Great Britain (1). — CUTHBERTSON W., in *The Gardener's Chronicle*, Series 3, Vol. LXXI, No. 1836, p. 104. London, March 4, 1922.

RESISTANT
PLANTS

During the summer of 1917 many potato fruits were gathered in some large fields in Scotland. In each case the fruits were taken from near the centre of extensive zones so that it was probable that the flowers had been self-fertilised and not contaminated by the pollen of other varieties.

The seeds were sown in the spring of the following year, and in October the tubers produced by each of the plants grown from these seeds were lifted.

In the spring of 1919, the six best tubers of each of the varieties used in the experiment were planted at Ormskir. At the harvest at the end of September, careful note was taken of the immunity of the tubers to *Synchytrium Solani*.

From the numerous data thus obtained attention is drawn to the varieties Priory Queen, Favourite and Admiral which all belong to the Abundance type noted for its marked resistance to the parasite.

G. T.

(1) See *R. Mar.* 1922, No. 226. (Ed.)

- 513 - Type of Cotton Plant cultivated in Montserrat, Antilles, resistant to Disease and seldom attacked by "Cotton-Stainers" (*Dysdercus* et *Oxycarenus* spp.). — See No. 368 of this Review.
- 514 - Resistance of Venezuela Cocoa Varieties against Attack of *Monilia*, in the Republic of Ecuador. — See No. 427 of this Review.
- 515 - *Botrytis antherarum-Trifolii*, injurious to the *Trifolium pratense*, in Germany. — See No. 402 of this Review.
- 516 - *Fusarium* sp. a Deuteromycete, the probable Cause of Disease of the Leguminosae, *Crotalaria juncea*, and *C. usaramoensis*, in Tonkin (1). — VINCENTS F., in *Bulletin agricole de l'Institut scientifique de Saigon*, Year III, No. 12, pp. 381-384, Saigon, December 1921.

At the end of September 1921, the Phytopathological Laboratory of the Scientific Institute of Saigon (Indo-China), received a large number of diseased specimens of *Crotalaria juncea* from the Agricultural Station at Tuyên-Quang (Tonkin).

From information furnished by the sender, it appears that the disease begins at the base of the plant and gradually invades the stem, causing it to wither and die. All the crops of *C. juncea* growing at the Station had been destroyed in this manner, and those of *C. usaramoensis* which had long proved resistant to the disease, began to be attacked at the beginning of September. The dry specimens that reached the Institute, did not enable a very clear idea to be formed of the appearance of the diseased plants. The cortex of the stem and roots was affected in the region of the root-collar, and in the case of some specimens where the wood beneath the cortex was discoloured and more or less brown, sections from the affected regions revealed the presence of a hyaline mycelium passing between the cells of the cortex and invading the wood vessels.

Upon stems and roots kept in a damp plate there appeared the characteristic fructifications of the following micromycetes; *Fusarium* sp., *Neocosmospora vasinfecta*, *Melanospora* sp., and subsequently, *Cucurbitaria* sp. and *Diplodia Theobromae*(?). Upon all the plants under observation only *Fusarium* sp. was found; this Deuteromycete appeared after a few days upon the sections of stem and roots containing the hyaline mycelium, and was the only fungus that developed upon the sterile cultural media upon which had been laid fragments of wood taken with every aseptic precaution, after the externally-sterilised cortex had been removed.

From the observations made on the material received *Fusarium* sp. seems to be the probable cause of the disease.

Although the author and his collaborator PHAM-TU-THIEN, have found *Fusarium* sp. and *N. vasinfecta* present at the same time upon *Crotalaria*, it is not certain that these two fructification forms belong to one species.

N. vasinfecta is regarded as the perfect form of *F. vasinfectum* a formidable parasite of cultivated plants and, amongst others, of the cotton-plant, in which it produces a serious disease of the root-collar.

(1) See also *R. Jan.* 1916, No. 123 and *R. Jan.* 1919, No. 729. (Ed.)

The form of *Neocosmospora* found on *Crotalaria* is morphologically similar to that parasitic on the cotton-plant; this is not the case with the two forms of *Fusarium* and the second conidial form of the *Cephalosporium* type to which they give rise.

The Deuteromycete, which is suspected of being the cause of the disease attacking *Crotalaria* in Tonkin, seems to resemble in its morphological characters *Fus. udum* which produces the wilt disease of *Cajanus indicus* in India.

The symptoms of the disease, and the presence of *Fusarium* unaccompanied by other fungi in the woody tissues of the infected plant, indicate that this is probably an instance of a "pathological withering" identical in origin with the wilt disease described by English and American observers.

No direct means of controlling this disease are known. The infection takes place in the soil and it is there that the parasite should be destroyed. Antiseptics have not given results which would warrant their use for warm crops.

Good results can be obtained by a rotation of at least three courses. The intermediate crops must not consist of plants belonging to the same family as those which have to be protected by this means. The spores of the parasite remaining in the ground after the removal of the crop will eventually disappear.

The best control method is undoubtedly the creation of resistant varieties. By this means particularly encouraging results have been obtained in combating diseases produced by *Fusarium*. G. T.

17 - *Colletotrichum Gossypii* and *Cercospora Batatae*, Deuteromycetes new to the Philippines and Injurious to the Cotton Plant and the Sweet potato respectively. — WELLES C. G., in *The Philippine Agriculturist*, Vol. X, No. 5, pp. 253-254. Los Baños, Laguna, December 1921.

Colletotrichum Gossypii Southw., the metagenetic stage of *Glomerella gossypii* (Southw) Edg., which produces the disease known under the name of cotton anthracnose, has recently been observed on the cotton plants at the Los Baños College of Agriculture.

As this parasite has not hitherto been reported from any other part of the Philippines, the spread of the disease can probably be prevented by careful seed selection and the application of efficient quarantine measures to all cotton grown at the College.

The fungus can exist in the seeds and dead tissues in the soil for a long time, and is thus very difficult to control. Cotton should not be grown indefinitely on soils infected by this disease, and as in the case of other crops, recourse must be had to a system of rotation. The danger of infection could be greatly diminished by the removal and burning of the plants after the harvest, while the spread of the disease on the stems of the host plants would be checked by taking the seed from healthy plants only.

The presence of *Cercospora Batatae* Zimm. has also been observed at

the Los Baños College of Agriculture on the sweet potato; this is the first time the parasite had been found on that plant in the Philippines, although it had previously been reported as doing great damage to the leaves of the sweet potato in South China. Rotation of crops might prove efficacious; it would also be advisable to plant the sweet potato during the driest months of the year. G. T.

- 518 - *Cercospora Arachidis* [var. *macrospora* n. var., a Hyphomycete Injurious to the Pea-Nut in Lombardy, Italy. — MAFFEI L., in *Rivista di Patologia vegetale*, Year XII, Nos. 1-2, pp. 7-11, Pavia, March 29, 1922.

On a farm in the Commune of Bereguardo (Prov. of Pavia), during the second half of September 1921, round or oval spots of a dark chestnut colour, and sometimes reaching 1 cm. in diameter, were found frequently in large numbers, on the leaves of *Arachis hypogaea*.

These spots were caused by a Hyphomycete of the genus *Cercospora*. The fructifications of this fungus developed in the spots on either surface of the leaf.

The parasite, which is new to Italy, is provisionally described as a variety (var. *Macrospora*) of *C. Arachidis* P. Henn.

It is advisable to cut off the aerial portions of the plant attacked and not to feed them to cattle or use them as manure. G. T.

- 519 - The Mucoraceae, *Rhizopus nigricans*, Injurious to Pumpkins, in Italy. — CIFERRI R., in *Rivista di Agricoltura*, Year XXVII, No. 13, pp. 195-196, Pavia, March 31, 1922.

In 1921 a disease appeared in damp and particularly in low-lying places in the neighbourhood of Alba, which although not very wide-spread caused considerable damage here and there among the pumpkins. As soon as the pumpkins ripened, large dark, irregularly rounded spots were seen on the surface and these patches spread so extensively that the fruit became soft and was changed to a brown colour. The pulp of the pumpkin attacked was blackish-brown and the exterior of the seeds also turned brown. The mesocarp from which there exuded a hyaline, non-putrid liquid, was seen under the microscope to be greatly disorganised and invaded by a mycelium, at first hyaline, and afterwards of a greyish colour. In the mycelium were embedded black, roundish bodies (sclerotia), which helped by their number to give to the pulp its blackish colour.

Pieces of infected pumpkin when placed in a moist, warm chamber soon became covered with a thick growth of a Mucoraceae identified as *Rhizopus nigricans* Ehr., a ubiquitous, very common saprophytic fungus known to occur as an occasional parasite.

In the case of pumpkins all the diseased fruits should be destroyed and they should not be planted in very damp places. G. T.

- 520 - *Penicillium crustaceum*, the Cause of Rot in Quinces, in Italy. — CIFERRI R. in *Rivista di Patologia vegetale*, Year XII, Nos. 1-2, pp. 12-17, Pavia, March 29, 1922.

It has been noted that in the Marches, Emilia, Piedmont, and several other parts of Italy, quinces kept in damp places are liable to a chestnut

brown rot which sometimes destroys the entire crop. At first a very small brown spot like a bruise is seen on the fruit, which increases in size and becomes depressed and the tissues of the hollow part soften. At the end of a few days half the fruit is attacked by this rot and gives out the characteristic smell of organic substances in course of fermentation and decomposition. Then a felt, at first of a whitish and later of a bluish colour, makes its appearance on the depressed spot and when the rot has spread to the whole quince it becomes invested with a greenish-blue covering of different shades.

The microscope has shown this affection to be the work of the polymorphous fungus *Penicillium crustaceum* (L.) Fr. a very common saprophyte and a facultative parasite.

The epicarp of perfectly healthy quinces when scratched by a needle infected with the conidia of this Mucedinea exhibits all the characteristic symptoms of the disease. If the conidia are placed on an entirely unbroken epicarp the results obtained are negative.

In order to prevent the outbreak of this disease, all quinces intended for storage must be free from any lesions and the fruit should be kept in a very dry place. The quinces must not touch one another and should not be piled up in heaps.

G. T.

WEEDS AND PARASITIC FLOWERING PLANTS

521 - *Striga densiflora* and *S. euphrasioides* Scrophulariaceae Parasitic on the Sugar-Cane in India. — LUTHERA JAI CHAND, in *The Agricultural Journal of India*, Vol. XVI, Part. 5, pp. 519-523, pl. 3 Calcutta, 1921.

In September 1920, the sugar-canes (var. "Katha") grown on the banks of the Sutlej were reported to be seriously affected. On investigation it was found that the plants were severely attacked by parasites belonging to the genus *Striga* (fam. *Scrophulariaceae*). Two species were discovered which were subsequently identified as *S. densiflora* Benth. and *S. euphrasioides* Benth. These plants grew in great numbers from the base of the sugar-canes, hundreds being massed together on a single spot. Groups of them were also found at a certain distance from the sugar-canes, but they were connected underground with the individuals attacking the root-system of their hosts. The two species of *Striga* were met with in different plantations: *S. densiflora* grew in the villages of Shergarh, Fatehgarh, Makowal etc., and *S. euphrasioides* in the fields of sugar-cane and of *Andropogon Sorghum* belonging to the village of Pawat.

The presence of *Striga* plants was remarked about seven years ago in the village of Garhi in the territory of the State of Patiala, and they have also been seen for three years at Shergarh and at Fatehgarh.

The sugar-canes attacked by the parasites are weakly, the leaves wither and the whole plant appears to be suffering from drought. Some of the sugar-canes are killed by the pests, whereas others are but little injured.

Striga has a very well developed root-system which encloses the rootlets of the sugar cane like a net. A number of suckers are put forth by the roots of the scrophulariaceae which fasten upon the rootlets of the host, and in this manner the parasite obtains all the nourishment it requires.

It is propagated only by seeds which when ripe fall in great quantities to the ground and grow at the same time as the host plant.

So far it has not been possible to make any specific recommendations as to control measures, but as in the case of other parasitic phanerogams, e. g. *Orobanche*, the development of *Striga* could doubtless be checked by pulling up the plants before the shoots have time to flower.

Since the cotton plant is not subject to the attacks of *Striga*, it is advisable whenever possible to grow cotton instead of sugar-cane in zones infested by these parasites.

G. T.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS

522 - On the Etiology of the Potato Disease known as Tip-burn in the United States (1). — EVER J. R., in *Science*, New Series, Vol. 1V, No. 1416, pp. 150-151, Uta, N. Y., February 17, 1922.

Researches have been made of recent years at the Experimental Station of Pennsylvania State College with the object of determining the etiology and specific cause of the potato disease called tip-burn due to the attack of *Empoasca mali*.

The experiments were carried out in the form of a series of inoculations with aqueous and alcoholic extracts of the Rhynchote and other insects living at the expense of the potato. The inoculated plants were placed in special cages and exposed to sunlight of different degrees of intensity in order to determine how far sunlight influences the development of the disease.

The results obtained led to the following conclusions:

- 1) Tip-burn of the potato can be induced by means of an extract obtained by maceration of the nymphs or adult forms of *E. mali* and is transmissible by direct inoculation; this indicates the presence of some specific substance, either inherent or of external origin and transmitted by the Rhynchote which is the actual cause of the disease.
- 2) The active principle of this substance is more energetic in the nymph stage of the Rhynchote.
- 3) The specific substance is present in the tissues of the diseased leaf after inoculation with the Rhynchote extract and can be transmitted by reinoculation to healthy plants.
- 4) This substance is of a definite nature and the disease cannot be induced by inoculation with extracts of insects other than *E. mali*, or by mechanical injury.

(1) See also R. Feb. 1922, No. 215. (Ed.)

5) Sunlight plays an important part in the progress of tip-burn after it has once begun, but the absence of sunlight does not prevent its appearance.
G. T.

- 23 - Observations made on the Life-History of *Laspeyresia pomonella* in the Valley of the Grand Colorado. — SIEGLER E. H., and PLANCK H. K. (in collaboration with the Colorado Agricultural Experiment Station,) in *United States Department of Agriculture, Bulletin* 933, 119 pp., figs. 36, pl. 7. Washington, D. C., 1921.

Laspeyresia pomonella L., which is generally regarded as the most destructive enemy of apples and pears, is very common and very destructive in the Valley of the Grand (Colorado).

In view of the great losses caused by this Microlepidopteron to the fruit industry of the district, it was considered advisable that a complete study of the life history of the insect should be made, in order to obtain some basis for control experiments.

These biological investigations were begun in 1915 and continued the following year according to the scheme devised by the Bureau of Entomology of the United States in collaboration with the Colorado Agricultural Experiment Station.

The Valley of the Grand is situated in the county of Mesa on the Western slopes of the Rocky Mountains, and possesses a relatively dry climate. The day temperatures are high during the summer, but the night temperatures are comparatively low.

These conditions are so favourable to the development of *L. pomonella*, that there are two complete generations and one incomplete generation of this insect during the year.

The authors give a detailed account of the careful observations made each of the above-mentioned years on the subjects of the duration of the chrysalis stage of pupation of caterpillars that have over-wintered; the deposition of eggs by the females coming from these caterpillars, the number of eggs laid by each female and the length of the life of the adults (both males and females) derived from the caterpillars that have overwintered. The authors also give the most minute details of the biological investigations respecting the different stages of the first, second and third generations of the insect.

In the Valley of the Grand, the natural enemies of *L. pomonella* are of little importance.

The beetle *Tenebroides corticalis* Melsh. and the Arachnid *Coriarachne ruficolor* Keys. have been reported as preying upon the caterpillars of the Microlepidopteron. An unsuccessful attempt was made to introduce the very well-known Coleopteron *Calosoma sycophanta* L. *Trichogramma evanescens* Riley and *Dibrachys clisiocampi* Fitch have been found parasitic to the eggs and caterpillars respectively. The parasite *Arthrolitus apae* Ashmead has been obtained by breeding.

The adult individuals of *L. pomonella* hatch later in orchards than in fields, but the period of hatching is shorter in the orchards. Most of the adult insects, whether derived from the caterpillars that have hibernat-

ed or from those of the first generation, emerge during the latter part of the morning and the early hours of the afternoon, the largest number appearing as a rule between 9 and 11 a. m.

L. pomonella makes short local flights, but does not otherwise appear to be a migratory insect. The adults can however make continuous flights, of at least eight hundred metres, without any assistance from the wind.

The females of the microlepidopteron lay most of their eggs between late afternoon and early evening, ovipositing being especially active at dusk.

L. pomonella is very productive in the valley of the Grand. Three females of the first generation laid in captivity over three hundred eggs each, the largest total number of eggs laid by a single female being three hundred and sixteen, while the largest number laid in a day by one female was a hundred and fifteen.

On June 24, 1915 an orchard consisting entirely of pear-trees was examined in order to determine the cause of the leaves turning brown. It was found that the change of colour was due to the caterpillars of *L. pomonella* which, having found no fruit at their disposal, had excavated galleries in the ends of the branches of the pear-trees.

In districts where there are large numbers of *L. pomonella*, bands are very often used instead of sprays in the control of the insect. A band of material is placed round the trunk of the tree and removed about every ten days when any caterpillars that have made their cocoons under the band are destroyed.

In 1916 an experiment was made by surrounding trunks with bands of material folded in such a manner that white stripes alternated with black, and this proved that the microlepidopteron preferred to pupate under the dark portions. It must not be assumed however that the light bands are useless, for it is probable that if the caterpillar can find no better place to spin its cocoon, it will content itself with making it beneath them. In practice fruit growers have found that bands of packing cloth folded two or three times answer the purpose quite well.

The variety of the Microlepidopteron to which was given the name of *L. pomonella* L. var *simpsonii* Buck. was reared during the course of the study of the apple parasite from material collected in the open in the Valley of the Grand. G. T.

524 — Propagation of Date Palms by Cuttings favouring the Development of *Phenacoccus Marlatti*. See No. 435 of this Review. (Ed.).

525 — Resistance of *Colix Lacryma Jobi* var. *mayuen* to animal Pests in the Philippines. — See No. 412 of this Review.

526 — *Triphleps tantilus*, a Natural Rhynchote Enemy of the Pink Cotton Boll Weevil (*Platyedra gossypiella*), in India. — BALLARD E., in *The Agricultural Journal of India*, Vol. XVI, Part 5, pp. 571-573. Calcutta, 1921.

In 1921 *Triphleps tantilus* Motsch. appeared in large numbers at Coimbatore, which confirmed the statement made in the preceding year that

this Rhynchote can live as well upon the eggs as upon the scarcely hatched larvae of the Pink Cotton Boll-Weevil. The nymphs of *Tr. tantilus* seem to attack the boll-weevil more greedily than the adult insects. A laboratory experiment has shown that the nymphs of the Rhynchote prefer the caterpillars to the eggs of *Platyedra*. It is unlikely that *Tr. tantilus* often has an opportunity of catching the *Platyedra* caterpillars in the open because as soon as they emerge from the eggs the caterpillars find their way into the nearest bolls. As, however, *Pl. gossypiella* lays its eggs in places that are much frequented by the Rhynchote, a large number must be destroyed by *Tr. tantilus*, which also lives upon other insects that are parasites of the cotton-plant. G. T.

527 - *Terpsiphone paradisi*, A Bird Useful to Agriculture in India. — FLETCHER, T. B. and INGLIS, C. M., in *The Agricultural Journal of India*, Vol. XVI, Part 5, pp. 476-482, 1 coloured Plate, Calcutta, 1921.

The authors give the descriptive characters of *Terpsiphone paradisi* (Paradise Flycatcher), and describe its habits.

This bird is found throughout India, from Afghanistan and Cashmere to Ceylon, except in the North-West to the East of the Brahmapootra, where it is replaced by *T. affinis*. It is to be met throughout the year in most of the districts of the plain, but it makes local migrations for definite periods. *T. paradisi* seems particularly common in North India. It feeds on small beetles, Diptera, Rhynchotes, Formicids and Arachnids, which it catches on the wing. It thus does great service to agriculture and for this reason is protected by law in Bengal, the Presidency of Bombay and in Burmah. It is probably protected also in Mysore. G. T.

528 - Insect Enemies of Rice in the Philippines. — See No. 409 of this Review.

529 - *Leptocoris acuta*, a Rhynchote injurious to Rice in the Philippines (1). — UICHANCO, I., in *The Philippine Agricultural Review*, Vol. XIV, No. 1, pp. 87-123, 4 pl. Manila, 1921.

INSECTS, ETC.
INJURIOUS
TO
VARIOUS CROPS.

It would appear from the entomological investigations that have been carried out for fifteen years by the Bureau of Science in all parts of the Philippines, and from experiments made for four years in the open by the author at Los Baños and in the neighbourhood, that the representative of the genus *Leptocoris* which attacks rice crops in these islands may be identified as *L. acuta* Thunb, known as the "rice bug." STAL has also reported the presence of *L. varicornis* Fabr (2) in the Philippines in 1870, but judging from the descriptions given by DISTANT, the characters ascribed to *L. acuta* and *L. varicornis* do not vary sufficiently for the two insects to be regarded as belonging to distinct species.

This Rhynchote is known in many parts of the Philippines under very similar local names.

(1) See also *R. Jan.* 1913, Nos. 27 and 120; *R. Oct.* 1914, No. 971. (Ed.)

(2) See *R. Oct.* 1914, No. 971, and *R. May* 1918, No. 604. (Ed.)

L. acuta is widespread throughout the Philippine archipelago and causes much damage in all the rice-growing provinces. It is also known in India, China and Java — where it is commonly called “walang sangit” (1), — in Celebes, Sumatra, Borneo and others of the Sunda Isles, as well as in Australia. Very probably it exists also in Japan.

Up to the present no study has been made of the life-history of the insect in the Philippines.

During the coolest hours of the day, in the early morning and late afternoon, the nymphs and adults of *L. acuta* may be seen on the young rice panicles. Towards midday the insect seeks refuge from the intense heat of the sun and retires to the lower parts of the plants such as the leaf bases.

Although a certain number of the Rhynchotes may sometimes be found on a single rice panicle, *L. acuta* has never been observed to be gregarious during any of its developmental stages. In the rice fields the adults are usually more plentiful than the nymphs.

On the farm of the Agricultural College at Los Baños it was observed that a considerable number of *L. acuta* in all stages of development made their appearance in August, September and October, becoming numerous in November and still more plentiful in December. In the two latter months the caryopses of the rainy season rice crops are in the soft stage. In January when there is generally a drought accompanied by a very high temperature, the Rhynchote can obtain but little suitable food and its numbers therefore decrease in this and the two or three following months. Rice grown during the dry period and reaching the soft stage about March or April and during the first half of May, when it is generally very hot and dry, has been found to be less attacked by *L. acuta* than rice cultivated during the rainy season.

From the time it leaves the egg and throughout all subsequent stages the Rhynchote is capable of injuring the rice grain. The insect feeds on grains which are still in the soft stage, by inserting its sucking apparatus at the point of least resistance, namely at the conjunction of the paleae. Some days after the puncture has been made, a yellowish-brown spot is seen on the paleae, which increases gradually in size and marks the place of the wound. The grain that has been attacked does not develop normally and, though it may attain the ordinary size, is never more than an empty envelope. It is uncertain whether the subsequent growth of the caryopsis is hindered by the direct effect of the mechanical lesion produced by the insect sucking out the contents of the grain which is in course of development, or by the introduction into the grain of an enzyme or some other deleterious substance during its attack. Such seeds as shown by their external appearance that they have been attacked by *L. acuta* have a bitter or unpleasant taste which would seem to indicate that these pathological results must be due to other factors than a simple mechanical injury.

(1) See R. Oct. 1917, No. 978 and R. Feb. 1919, No. 260. (Ed.)

The nature of the injury wrought by *L. acuta* causes it frequently to be mistaken for the work of *Schoenobius incertellus* Walk (paddy-borer), but in this case, all the grains of the panicle are empty and of a uniform pale straw colour, whereas when a panicle has been attacked by *L. acuta*, owing to the insects' method of feeding, some only of the grains are empty, while the rest develop normally; further, the characteristic yellowish-brown spots are to be seen on the panicle at the spot where the insect has inserted its sucking apparatus.

L. acuta probably causes more economic damage to the rice crop in the Philippines than any other insect and the crops of rice grown during the rainy season are often diminished 50 % or more owing to its attacks.

If one rice-field is planted earlier than the others in the same neighbourhood, the rice which has been first planted attracts all the individuals of *L. acuta* present in the district as soon as it has reached the soft dough stage. One planter of Bay (Laguna), lost over 70 % of his rice crop in 1918 for this very reason. Similar results occur when early varieties of rice are planted with late varieties.

From observations made at Los Baños in 1918, *L. acuta* appears to have a decided preference for certain varieties of rice, Binicol for instance is particularly liable to attack, possibly on account of its sweeter taste and characteristic smell, coupled with the fact that the paleae are not so strongly united, which facilitates the passage of the proboscis of the insect to the caryopsis.

Most of the awned varieties have proved to be immune, the awns probably acting as a protection against the intruder; further, in these varieties, the paleae are stronger and more solidly united at the angles.

L. acuta is only able to injure rice grain when it is in the soft dough stage.

During the months when rice is not grown, or when it has not reached the soft stage, *L. acuta* lives at the expense of various wild plants. The insect seems, however, to prefer rice to any other of its host plants and returns to it at the earliest opportunity.

Adult individuals of the Rhynchote have been seen in the Philippines, far from any rice plants, on *Panicum flavidum* and *P. colonum* and when these Gramineae were growing together on the same ground, the insect always showed a preference for the second, no doubt because its grain is the more succulent. The nymphs of the Rhynchote have been found on *Pegleria consanguinea*. The insect has also been reported as living at the expense of *Cibrus* sp. Its eggs have been found on a leaf of *C. decumana* and egg-capsules on a leaf of *Phytolacca dioica*, but experiments have shown that *L. acuta* cannot obtain a suitable food supply from either *C. decumana* or *Phyt. dioica* and that the eggs found on the leaves of these plants had probably been laid there by accident.

Subsequent experiments carried out with nineteen species of plants many of which represented the commonest weeds of the rice-fields, at Los Baños and its neighbourhood, have shown that *P. colonum*, *P. flavidum*, *C. criss-galli*, *P. reptans* and *D. consanguinea* act as good host-plants to

L. acuta, for some individuals have been able to reach the adult stage, mate, and deposit eggs upon them. From the results of the experiments it appears that *Andropogon Sorghum* which is stated to be a host of *L. varicornis* in India, does not furnish food suitable to *L. acuta*. In the laboratory the *L. acuta* does fairly well on *Paspalum conjugatum*, *Panicum barbinode*, *Dactyloctenium aegyptiacum*, *P. carinatum*, *Cynodon Dactylon*, *Eleusine indica* and *Cyperus Iria*, but only until it has reached the second or third phase of the nymph stage. The author cannot at present say for certain that these latter plants are less suitable hosts from the food point of view than the 5 others mentioned above. The premature death of the nymphs might have been due to other factors and not to unsuitable nourishment.

Although the results of these experiments do not justify any definite line to be drawn between the plants upon which the Rhynchote can feed and those that are unsuited to it, they show that some wild plants are good hosts for the insect.

The author gives a detailed description of all the stages of the Rhynchote.

Under laboratory conditions it was found that the male lived from twenty-six to ninety-seven days after hatching, the average being sixty-two days; the females lived from sixty-five to a hundred and twenty-four days, the average being eighty-nine days.

The female does not attain sexual maturity until after a period varying from seven to twenty-seven days after hatching.

Mating takes place at least three times during the life of the female and always in the morning.

Oviposition is most active from six in the evening to six in the morning. The female lays her eggs from eleven to forty days after hatching out, the average being twenty-four days. Under laboratory conditions it has been found that the length of the laying season varies from thirty-eight to eighty-two days, with an average of sixty-five days and the female lives eleven days after the end of the laying period. The number of eggs deposited by one female in a day varies from none to twenty-three and the total number of eggs laid during the season varies from a hundred and five, to three hundred and thirty-four with an average of two hundred and twelve.

The eggs are generally deposited in one or two linear series along the median vein, on the upper surface of the leaf, at a short distance from the tip.

In the laboratory the incubation period varies from six to eight days with an average of seven and a quarter days.

The nymph moults five times before attaining the adult stage; the complete nymph stage extends over a period of time varying from seven to twenty-three days, with an average of 19.6 days.

In addition to the absence of wings and of reproductive organs in the nymph and the difference in the number of segments the chief characteristics distinguishing nymphs from adult insects are the position of the sex

organs, which in the nymphs are situated between the third and fourth and the fourth and fifth abdominal tergite, whereas in the adults they are placed on the metathorax; and in the number of the tarsal segments, two in the case of the nymph and three in the adult insect.

The predatory Coleopteron *Cicindela sexpunctata* Fabr., which the author has never been able to find in the course of his researches, and a Hymenopterous egg parasite belonging to the family *Proctotrypidae*, have been reported as natural enemies of *L. acuta* in the Philippines.

As a result of his biological observations, the author makes some suggestions respecting the control of *L. acuta* as a starting point for further investigation.

In the first place everything should be done to increase the number of the egg parasites named, and it is necessary to import from India and other old rice-growing countries, egg-parasites as well as predatory insects that are not found in the Philippines.

The rice ought to be planted in such a way as to insure that all the crops grown during the rainy season reach the soft dough stage at about the same date in a given locality. Wherever water for irrigation is plentiful it is advisable to delay planting, so that the grain may not reach the soft dough stage before the end of January, or even as late as February.

Care should also be taken to obtain, by means of selection and crossing, types of rice that are either immune or nearly so.

Since early crops of rice planted on a small area are a great attraction to the Rhynchote, many such small plantations should be made in several places in a given district to serve as traps. After the adult insects have collected in large numbers in these small rice-fields and have laid their eggs, the plants can be burnt and in this way the adult individuals, the eggs, and any nymphs that may have developed, are destroyed. The adult insects can be attracted by pieces of putrifying meat or other suitable bait, and then killed.

They can also be captured in special long bags which are dragged across the field, as is done in India.

During the rice-growing season weeds which ripen before the crop and form hosts for the Rhynchote must be uprooted from the rice-fields. The slopes should also be cleared of all weeds. After the rice has been harvested the ground ought to be ploughed and planted with another crop, and should not be allowed to be invaded by weeds, as commonly occurs in many parts of the Philippines.

The eggs may also be collected by hand.

Insecticides acting by contact, such as kerosene emulsion, and applied by means of a knapsack sprayer may be very efficacious, especially in controlling the nymphs, which generally congregate on the panicles during the coolest hours of the day. The spraying should be carried out early in the morning, or late in the afternoon and the insecticide must only be directed against the panicles. As rice is only subject to the attack of the Rhynchote during the soft stage which lasts for about a month, the treatment must be limited to this period. The spraying should be repeated

fairly frequently during the month in order to destroy any insects that may have fallen on the ground, or otherwise escaped the previous applications.

G. T.

530 - *Dysdercus* sp., a Rhynchote injurious to *Hibiscus Sabdariffa* var. *altissima* in the Federated Malay States. — See No. 420 of this Review.

531 - *Laphygma exempta*, a Macrolepidopteron Injurious to Sugar Cane and Maize, new to Queensland. — JARVIS, E., in *The Queensland Agricultural Journal*, Vol. XVI, Part 4, pp. 276-280, 1 plate. Brisbane, 1921.

The presence of *Laphygma exempta* Walk. was reported for the first time at Meringa near Cairns, on February 18, 1920. The larvae were already more than half-grown and had done considerable injury to the leaves of the sugar-cane and to the young maize plants.

The caterpillars were swarming in thousands over an area of about one hundred acres, but were still more numerous on the grassy strips and the edges of the fields.

They carried on their depredations in the full sunlight and could be clearly seen eating up the greater part of the leaf blades of which they often left only the median vein intact.

By February 21 the larvae were fully grown. Two hundred of them were collected and put into breeding cages and after two days all the caterpillars burrowed in the soil to pupate.

The chrysalis stage lasted from seven to eleven days; the first adult insect emerged on March 1. During the following 5 days forty-one adults appeared, of which twenty-five were males and six females. Only 20.50 % of the two hundred caterpillars reached the adult stage. They were parasitised in the proportion of 33.50 % by a Tachnid, 1 % being attacked by Hymenoptera. The forty-five other caterpillars apparently succumbed to the attack of a disease of bacterial origin.

The author gives a description of the caterpillar, chrysalis, and adult form of *L. exempta*. This Macrolepidopteron is a native of Africa, and appears never to have been observed before in the Queensland sugar-plantations.

In addition to the parasitic Tachnid already mentioned, its natural enemies are the parasitic Hymenoptera *Metopius unifestratus* Mer., and *Iphiaulax dubitorius* Fabr., and the predatory Coleopteron, *Ophonoides australis* Dej.

Should the insect do further damage, it is well to remember that the young caterpillars must be destroyed as soon as they appear. The method with a poisonous solution usually adopted is to water the grass between the bands of caterpillars and the crop to be protected.

The following formula is prescribed in Rhodesia: sodium arsenite 1 kg.; liquorice, 8 kg.; water, 1 hectolitre.

When the attack is confined to a limited area, it is better to use a solution of calcium arsenite to which has been added 600 gm. of liquorice per hectolitre of water.

G. T.

532 - *Cerococcus parahybensis*, a Scale-Insect found on the Coffee Plant, in the State of Parahyba, Brazil. — MOREIRA, C., in *Chacaras e Quinças*, Year XIII, in Vol. XXV, No. 1, pp. 28-30, figs. 2. São Paulo, January 15, 1922.

Cerococcus parahybensis Hempel, popularly known under the name of "vermelho", is most probably a parasite of the coffee-plant in the State of Parahyba, where, however, its presence was noticed only in 1921.

This scale-insect does not spread rapidly in the zone of coffee-cultivation, and is only represented there by a limited number of individuals on each plant. When this pest occurs in large numbers upon coffee-plants that have already been weakened, it furthers the destruction of the plantations, though in many cases this cannot be attributed to the insect, but is due to negligent cultivation.

The number of female insects exceeds that of the males.

The development of *Cerococcus parahybensis* is favoured by damp, and the parasites multiply greatly in the rainy season. The breeding season lasts from July to August and in October when the dry season is at its height, the insects have been found in a dying condition.

Some traces of natural enemies of this coccid have been observed.

It is impossible to employ insecticides, but the insects can be removed by the application of a hard brush or by hand.

It is necessary to cut down and burn any neglected coffee-plants that have been attacked by the parasite. The spring cultivation of the coffee plantations in the State of Parahyba should be improved, and apart from the seeds, all transport or removal of young coffee plants, or parts of plants, within the State should be prohibited.

G. T.

533 - *Ypsolophus marginellus*, a Microlepidopteron injurious to the Juniper, New Jersey, United States. — WEISS, H. B., and LOTT, R. B., in *Entomological News*, Vol. XXXIII, No. 3, pp. 80-82. Philadelphia, March 1922.

This European species has been reported in America from the State of New York, Connecticut and New Jersey, where it occurs in its larval stage upon the Juniper.

For several years *Ypsolophus marginellus* Fabr. (the Juniper web-worm) has been increasing in various parts of New Jersey, where it has done considerable damage. At the present time this Microlepidopteron is certainly to be found at Rutherford, Scotch-Plains, Springfield and New Brunswick, where it is especially common in the nursery-gardens. The caterpillar appears to confine its depredations to the leaves of *Juniperus communis* and of its varieties *aurea*, *horizontalis*, *depressa*, *hibernica* etc. The insect winters between the leaves which it fastens together by means of a web, retiring into these nests when from half to fully grown.

In the north of New Jersey, the larvae begin active life in May; they live on the more or less dry leaves, until they attain their full development when they pupate in large numbers after the middle of the month. The insect encloses itself in a white silky envelope placed between the partially eaten leaves which are covered with a web. The first adults come out towards the end of May or at the beginning of June; the largest number emerging about the middle of June. The eggs are laid singly, and quanti-

ties are usually found on the young terminal shoots in the angle between the stem and the leaf insertion; eggs are also sometimes laid on the shoots or stems. The incubation period has not been definitely observed: the first caterpillars, 0.5 mm. in length, were seen on July 8. On leaving the egg the larvae begin feeding on the upper epidermis of the young leaves, which become discoloured in places and finally turn entirely brown. Towards the end of July, when the caterpillars are about 2 mm. long, their webs are clearly visible. As the larvae grow, their gregarious tendency becomes more evident, and the leaves of the host-plant are more thickly enveloped in the webs. These webs first enclose the terminal shoot and then envelop the branch for some centimetres below the tip this is repeated at different points on the plant which is thus destroyed. As the season advances the webs increase in size, they contain more excrement, and the leaves wither and die. Small plants such as those of the *hibernica* variety may be entirely covered by the webs from top to bottom. There appears to be only one generation of *Ypsolophus marginellus* in the year; the larvae grow slowly during the summer and hibernate throughout the cold season. In the spring when they again become active, the caterpillars find little green food at their disposal and appear to content themselves with dead leaves. Fifteen or more of these grubs, are found nestling in a web.

The authors give a morphological description of each stage of the *Microlepidopteron*.

As regards control, they advise treating the infested plants with lead arsenate, either in the liquid or powder form, during the last fortnight of June or the first half of July, for at that time the webs are small, thin and easily penetrated. Later on powder cannot be employed, and it is necessary to have recourse to spraying, in order to penetrate the foliage which is most closely enveloped by the webs of the insect. In the case of certain varieties of juniper, the nests containing the caterpillars can be cut off and burnt at the beginning of spring.

G. T.

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